蛇蛙研究

CHINESE HERPETOLOGICAL RESEARCH

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赵尔宓 编

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内 容 简 介

《蛇蛙研究》主要报道以两栖爬行动物为研究对象的生物化学、生物学、细胞学、生态学、生理学、分类区系、毒理学等方面的科学论文，实验方法，国内外研究综述等。

Brief Introduction

Each book of the Chinese Herpetological Research mainly publishes theses on the biochemistry, biology, cytology, ecology, physiology, fauna, toxicology, etc. of reptiles and amphibians used as research materials, and on the experimental methods involved, as well as reviews on current developments, at home and abroad, in this field.

蛇 蛙 研 究 **CHINESE HERPETOLOGICAL RESEARCH**

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剑蛇属中国产种类的分类学研究

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剑蛇属(*Sibynophis*)是分布于亚洲的一属中小型蛇类，其特征是：齿骨后端与隅骨（或称上隅骨）游离，二者间有一定程度的活动性；牙齿细小均匀而数多，每侧上颌骨上可有25～56枚，各牙齿侧扁而端部略平，在上颌骨上形成剑形的锐利切缘，适于咬吃具硬鳞的蜥蜴如石龙子之类；全部背椎均具发达的椎体下突(hypapophysis)。本属与分布于中南美的铲齿蛇属(*Scaphiodontophis*)很相近，过去曾将此二属共置于剑蛇属。

本属已知共7种，我国有3种。黑领剑蛇 *Sibynophis collaris* (Gray, 1853)分布于喜马拉雅山南坡，西起Simla，东到中南半岛，我国记载于西藏东南部及云南，它以上唇鳞10枚，前颞鳞一枚，仅与最大的第八枚上唇鳞相切，区别于另二种(图1)。黑头剑蛇 *Sibynophis chinensis*(Günther, 1889)分布于我国南部广大地区及越南北部，上唇鳞9枚，前颞鳞2枚，下前颞鳞较大，与第七、八两枚上唇鳞相切。棕头剑蛇*Sibynophis grahami*(Boulenger, 1904) 系依据云南昆明与曲靖间一号标本所订名，以后曾在昆明与武定采到过标本。棕头剑蛇与黑头剑蛇很相近，所以Pope(1935, 81页)及Smith(1943, 3:276)仅以其具较少(83或以下) 尾下鳞与黑头剑蛇 (98或以上) 相区别。

Maki(1931)依据我国台湾省剑蛇属标本10号，以其腹鳞数偏低(164-179)订为台湾亚种(*Sibynophis collaris formosensis*——按其上唇鳞及颞鳞特征应隶*Sibyno[illegible]chinensis*)。经采用划分亚种的差异系数法将台湾标本与我国大陆各地黑头剑蛇标本进行比较，无论在腹鳞数、尾下鳞数或腹鳞与尾下鳞数之和等方面，二者均未达到划分亚种的标准。因此认为台湾标本作为黑头剑蛇的亚种是不能成立的。

近年，分别在位于四川与云南交界处的泸沽湖的云南一侧及四川西南部米易县采到一批剑蛇属标本，其尾下鳞数较多与黑头剑蛇似，但腹鳞数也较多又与棕头剑蛇似，由此引起作者的注意。于是，将我国各地被鉴定为此两种的标本加以比较，并参考文献记载，结果发现：黑头剑蛇与棕头剑蛇标本具以下共同特征：上唇鳞9，3-3-3式；眶前鳞1，眶后鳞2；颞鳞2+2，仅个别标本一侧的前颞鳞为1；二者的腹鳞与尾下鳞在两性间无明显区别，虽然黑头剑蛇的尾下鳞多于棕头剑蛇，棕头剑蛇的腹鳞多于黑头剑蛇，但腹鳞与尾下鳞数之和则较一致；此外，二者的色斑亦相似。因此认为：*Sibynophis grahami*(Boulenger, 1904)应为*Sibynophis chinensis*(Günther, 1889)的同物异名，其中文名仍称黑头剑蛇。

在详细比较黑头剑蛇各地居群的腹鳞与尾下鳞数(表1及表2)，结合地理分布特点（图2及图3）则可划分为三种类型。由图2可见：居群A以腹鳞数较少区别于居群B与C，其两两间的差异系数(Coefficient of Difference)均已达到划分亚种的标准；居群B以尾下鳞数少于居群C，彼此间的差异系数亦已达到划分亚种的标准。居群C以其腹鳞与尾下鳞数之和多于居群A，彼此间的差异系数也达到划分亚种的标准。因此认为：黑头剑蛇可划分为3个亚

Table 1. Ventral and Subcaudal Counts of *Sibynophis chinensis*.

Locality	n	Ventrals	Subcaudals	Ventrals+Subcaudals	Material or Reference
Yichang, Hubei	1	182	53+		Type of *S. chinensis*
Sichuan	16	172-184	83-119	258-295	Chengdu Inst. of Biol.
Gansu	2	179, 184	25+, 49+		Feng, 1981
Guizhou	3	171-186	104-114	285-294	Chengdu Inst. of Biol.
"	10	176-185	90-130	270-309	Wu et al., 1985
Guangxi	2	176, 176	50+, 112	288	Fan, 1931
Jiangxi	2	170, 175	74+, 81+		Chang, 1936
"	2	179, 180	108, 101	287, 281	Maslin, 1950
Fujian	6	174-180	107-125	287-299	Chengdu Inst. of Biol.
Hainan I.	1	173	81	254	Chengdu Inst. of Biol.
"	1	167	115	282	Schmidt, 1925
Taiwan	10	164-179	110-129	281-301	Maki, 1931
"	1	182	79+		Kuntz, 1963
Vietnam	1	165	107	272	Bourret, 1937
between Kunming and Kutsing	1	185	83	268	Type of *S. grahami* Pope, 1935
Yunnan	2	188, 194			Chengdu Inst. of Biol.
"	1	195	93	288	Wu et al., 1985
Western Guizhou	11	186-208	80-104	267-309	Chengdu Inst. of Biol.
Miyi, Sichuan	7	189-199	108-119	297-314	Yunnan University
Lugu, Lake Yunnan	3	196-199	112-115	310-312	

Table 2. Subspecific Differenciation of *Sibynophis chinensis*.

Population	n	Ventrals			Subcaudals			Ventrals+Subcaudals		
		range	mean	S. D.	range	mean	S. D.	range	mean	S. D.
A	58	164-187	177.4	5.09	81-130	108.8	10.93	254-309	285.9	10.78
B	15	185-208	193.3	6.32	80-110	95.8	8.32	267-309	289.5	12.67
C	10	189-199	194.8	3.73	108-119	113.5	3.51	297-314	309.1	5.82

Table 3. Description of *Sibynophis chinensis miyiensis*, ssp nov.

Number	Sex	Dorsal scales	Ventrals	Subcaudals	Upper labials	Lower labials	Loreals	Preoculars	Postoculars	Temporals	
CIB 105026	male	17-17-17	189	108	3-3-3	9/8(4)	1	1	2	2+3	
CIB 105027	"	17-17-17	194	110	3-3-3	9(4)	1	1	2	2+2	holotype
CIB 105028	"	17-17-17	192	119	3-3-3	9(4)	1	1	2	2+2	
CIB 105030	"	17-17-17	198	116	3-3-3	9(4)	1	1	2	2+2	
CIB 105031	"	17-17-17	199	115	3-3-3	8(4)	1	1	2	2+2	
YU 857012	"	17-17-17	198	112	3-3-3	9(4)	1	1	2	2+2	
YU 857013	"	17-17-17	199	113	3-3-3	10(5)	1	1	2	2+1	
YU 857021	"	17-17-17	196	115	3-3-3	10(5)	1	1	2	2+2	
CIB 105025	female	17-17-17	190	56+	3-3-3	9(4)	1	1	2	2+2	allotype
CIB 105029	"	17-17-17	193	99+	3-3-3	8(4)	1	1	2	2+2	

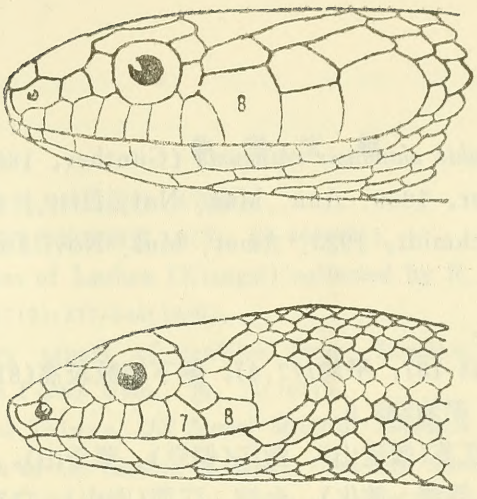

Figure 1. Head scalation of Chinese species of the genus *Sibynophis*.
upper: *Sibynophis collaris*
lower: *Sibynophis chinensis*

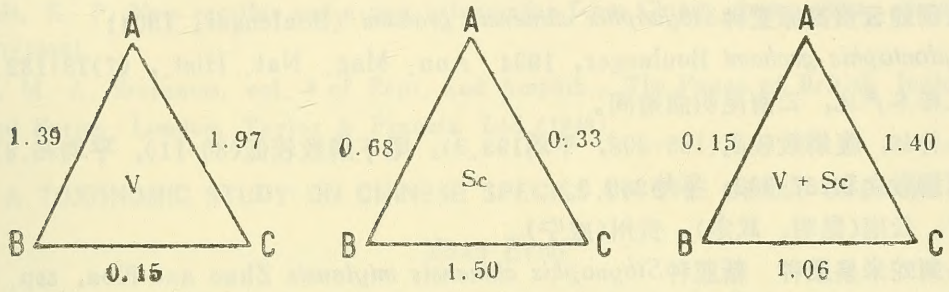

Fig. 2. Coefficient of Difference among Three Populations of *Sibynophis chinensis*.

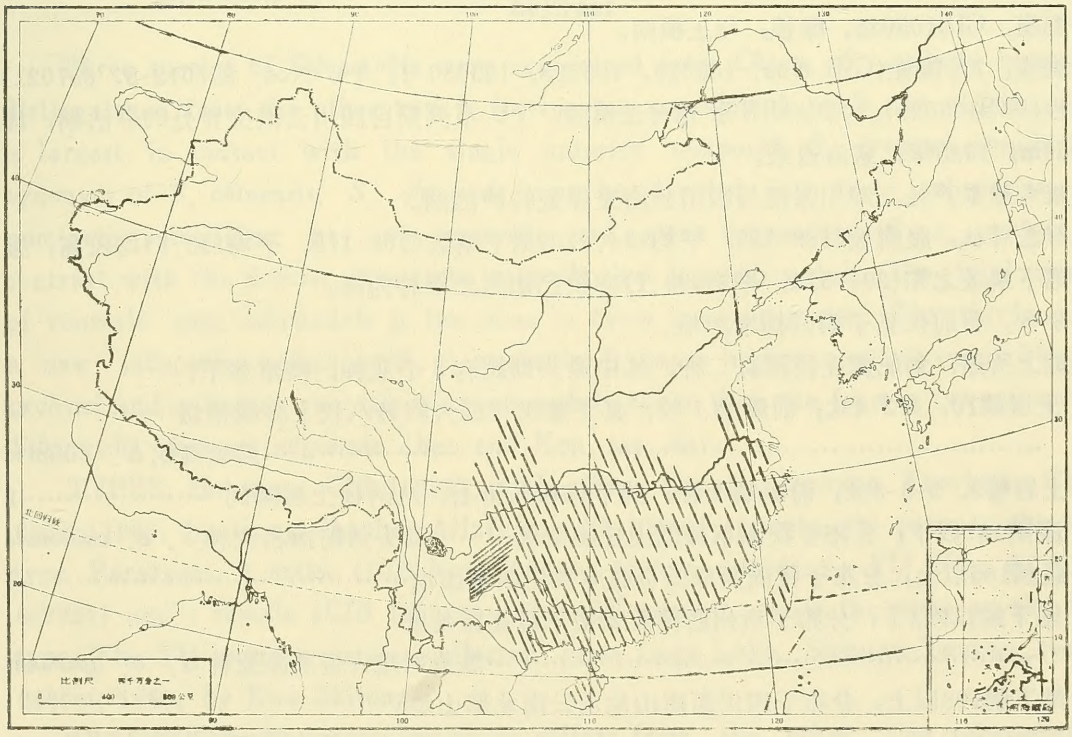

Figure 3. Distribution of subspecies of *Sibynophis chinensis*.
S. c. chinensis(dotted line)
S. c. grahami(black line)
S. c. miyiensis, ssp. nov.(black spot)

种如下：

1. 黑头剑蛇指名亚种*Sibynophis chinensis chinensis* (Günther, 1889)

Ablabes chinensis Günther, 1889. Ann. Mag. Nat. Hist., (6)4:220.

Sibynophis hainanensis Schmidt, 1925. Amer. Mus. Novitates, no. 157 (type locality: Nodoa, Hainan).

模式标本产地：湖北宜昌。

形态特征：腹鳞数较低(164-187，平均177.4)，尾下鳞数较高(81-130，平均108.8)，腹鳞与尾下鳞数之和254-309，平均285.9。

分布：国内已知产地有：江苏(栖霞山)，浙江(桐庐)、莫干山)，湖北(宜昌)，湖南(长沙)，福建(崇安、南平、福州、福清、德化)，台湾，江西(庐山)，广东(罗浮山、连平)，海南岛(那大、五指山)，广西(罗香)，贵州(印江、雷山、兴义、赤水、清镇、务川、贵定)，四川(九峰山、峨眉山、安县、宝兴、宜宾)，甘肃(徽县)，山西(石泉)。国外见于越南北部。

2. 黑头剑蛇云贵高原亚种*Sibynophis chinensis grahami* (Boulenger, 1904)

Polydontophis grahami Boulenger, 1904. Ann. Mag. Nat. Hist., (7)13:132.

模式标本产地：云南昆明曲靖间。

形态特征：腹鳞数较高(185-208，平均193.3)，尾下鳞数较低(80-110，平均95.8)，腹鳞与尾下鳞数之和267-309，平均289.5。

分布：云南(昆明、武定)，贵州(威宁)。

3. 黑头剑蛇米易亚种 新亚种*Sibynophis chinensis miyiensis* Zhao and Kou, ssp. nov.

模式标本：

正模：CIB105027，雄性；四川米易，海拔880m；1986年6月；康绍和采。

配模：CIB105025，雌性；与正模同。

副模：7号雄性(CIB Nos. 105026, 105028, 105030-1; YU Nos. 857012-3, 857021)，1号雌性(CIB105029)。其中CIB系列与正模同，YU系列采自四川云南交界处的泸沽湖，海拔2600m；1985年；寇治通采。

模式标本产地：四川米易与四川云南交界处的泸沽湖。

形态特征：腹鳞数(189-199，平均194.8)与尾下鳞数(108-119，平均113.5)均较高，腹鳞与尾下鳞数之和(297-314，平均309.1)亦较已知另二亚种为高。

分布：目前仅见于模式标本产地。

综上所述，剑蛇属在我国有二种，其中黑头剑蛇有3个亚种，检索如下：

1A 上唇鳞10，3-3-4式；前颞鳞1枚，其下缘仅与最大的第八枚上唇鳞相切……黑领剑蛇 *S. collaris*

1B 上唇鳞9，3-3-3式；前颞鳞2枚，其下缘楔入第七、八两枚上唇鳞间 ……2

2A 腹鳞187以下；分布于我国东部低山丘陵地区……黑头剑蛇指名亚种 *S. c. chinensis*

2B 腹鳞185以上；分布于我国西部云贵高原及川西南山地……3

3A 尾下鳞110以下；分布于贵州西部及云南东部高原地区……黑头剑蛇云贵高原亚种 *S. c. grahami*

3B 尾下鳞108以上，分布于四川西南山地及云南北部山地……黑头剑蛇米易亚种 *S. c. miyiensis*

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A TOXONOMIC STUDY ON CHINESE SPECIES OF THE GENUS *SIBYNOPHIS*

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Abstract

Three species of *Sibynophis* were recognized from China. *S. collaris* is readily distinguished from the other two in having ten supralabials with the eighth, which is largest, in contact with the single anterior temporal. *S. grahami* should be a synonym of *S. chinensis*. *S. chinensis* can be divided into three subspecies. The nominate subspecies has less ventrals and more subcaudals; *S. c. grahami*, in contrast with the former, has more ventrals but less subcaudals. The total number of ventrals plus subcaudals is the same in these two subspecies. The third one is a new subspecies named as *S. c. miyiensis*. It has a higher ventral count like the *grahami* and a higher ventrals plus subcaudals count than the former two subspecies. *Sibynophis chinensis miyiensis* Zhao and Kou, ssp. nov.

TYPES: Holotype: CIB 105027, male; Miyi County, Sichuan Province, China, 880m; 1986; by Kang Shaohe. Allotype: CIB 105025, female; the same as the holotype. Paratypes: 7 males (CIB Nos. 105026, 105028, 105030-1; YU Nos. 857012-3, 857021) and 1 female (CIB 105029). The CIB number series the same as the holotype. The YU number series collected from Lugu Lake, Sichuan-Yunnan border, 2600m; 1985; by Kou Zhitong.

DIAGNOSIS: This new subspecies differs from the other two subspecies in

having higher ventrals plus subcaudals count. It differs from *S. c. chinensis* in having more ventrals and from *S. c. grahami* in having more subcaudals.

DISTRIBUTION: Known from the type locality: Miyi County, southwestern Sichuan and on the shore of Lugu Lake, which constitutes part of the border between Sichuan and Yunnan.

This article was read by the author at the annual meetings of ASIH held at Albany 21-25 June, 1987.

Chinese Herpetol. Res. 1987:7-11

KARYTYPES OF CHINESE SPECIES OF OCCIDOZYGA (FAMILY RANIDAE), WITH DISCUSSION ON THE TAXONOMIC STATUS OF O. laevis martensi

(Plate I)

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The number of the species in the ranid genus *Occidozyga* is comparatively small; but the animals are widely distributed over Southeast Asia. In China, two species, *O. lima* (Gravenhorst) and *O. laevis martensi* (Peters) have so far been found. They range mainly over tropical and subtropical areas of Fujian, Hainan Island and the mainland of Guangdong, Guangxi, and Xishuang Banna and Hekou of southern Yunnan. The taxon *martensi* has for a long time been considered as a subspecies of *O. laevis* (Guenther), type locality in the Philippines. However, Liu and Hu (1961, p. 226) pointed out that there were considerable differences in morphology between the taxon *martensi* collected from China and *O. laevis* captured in the Philippines.

This paper reports the karyotypes of the two species of *Occidozyga* found in China, compares them with the reported karyotype of *O. laevis* distributed over the Philippines, and discusses the taxonomic status of the taxon *martensi* known to Chinese herpetologists. The results produce convincing evidence for the establishment of *martensi* as a valid species.

Materials and Methods

Table 1 lists the frogs examined in the experiments. Both ends of the femur, tibio-fibula, and humerus bones were scissored off, and the marrow cells were washed out with 0.46 M KCl for chromosome preparation by a centrifugal air-drying method (Zhao et al., 1983) and a direct mounting method (Wu, 1982). The samples were stained for 20 min with 2% Giemsa (diluted by PBS, pH 6.8-7.0). Readers

are asked to refer to the previous report by the same authors (Tan et al., 1986) for the methods for analysing interspecific chromosome variation and the variation between different populations of *martensi*.

Results

Plate I depicts the karyotypes of *O. lima* found in Xishuang Banna and of the two populations, Hainan and Xishuang Banna, of *martensi*. For the measurement of the karyotypes, see table 2.

The diploid number of the above-mentioned frogs is the same, 2n=26, comprising two groups.

The large chromosome group includes chromosome Nos. 1-5, with a relative length (R. L.) larger than 9%. It is worth mentioning that the R. L. of No. 1 in *O. lima* is very similar to that in the Hainan population of *martensi*, but quite different from that in the Xishuang Banna population. The difference in R. L. of the remaining chromosomes among the three populations is not prominant. With regard to the arm ratio (A. R.), chromosome Nos. 1, 4, and 5 of all three populations are metacentric (m); No. 3 is submetacentric (sm); No. 2 is submetacentric in *O. lima*, but metacentric in the two populations of *martensi*.

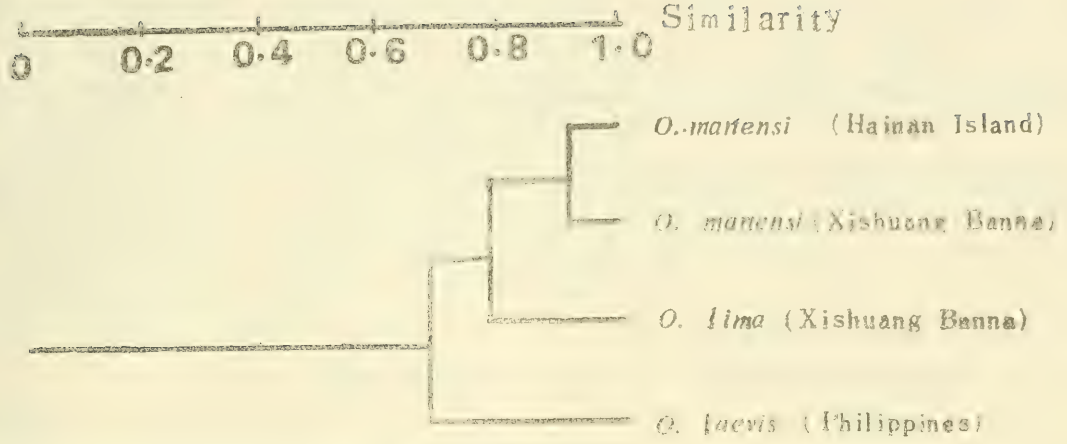
The small chromosome group comprises chromosome Nos. 6-13, with a R. L. less than 7%. The difference in R. L. is not obvious between *O. lima* and the Hainan population of *martensi*, but is prominant between these two and the Xishuang Banna population of *martensi*. Nos. 6, 7, 11, and 12 are metacentric; Nos. 8 and 9 submetacentric in all three populations. Nos. 10 and 13 are metacentric in *O. lima*, but submetacentric in the two populations of *martensi*.

The secondary constrictions of the Hainan population of *martensi* can be readily observed on the short arms of Nos. 6 and 7, and on the long arms of Nos. 8-10. A satellite can also be seen on the long arm of No. 3 in a few cells (plate I, B). No secondary constrictions were observed on the chromosomes of *O. lima* and of the Xishuang Banna population.

On the whole, the karyotypes of the two populations of *martensi* are the same, except for some differences in R. L. and in the centromeric type of chromosome No. 13 (sm in the Hainan population but sm or st in the Xishuang Banna population). Whether these differences are due to population variation caused by geographical isolation or they are the result of errors in observation and measurement is still unknown and will be settled by future studies.

Discussion

The taxon *martensi* was first described by Peters (1867) as *Phrynoglossus martensi* based on the specimens collected from Bangkok. Smith (1923) reported it from Hainan Island; Chang (1942) from Wuxuan and Tengxian Counties, Guangxi, and



* Similarity=$\frac{\text{Numbers of the same kind of centromeric type}}{\text{Total numbers of centromeric types compared}}$

Figure 1. Presumed phylogenetic relationships of the four populations of *Occidozyga*.

Table 1. The specimens examined in this study.

Taxon	Number	Sex	Locality	Date
lima	2	female	Xishuangbanna, Yunnan	June, 1986
martensi	3	female	Xishuangbanna, Yunnan	June, 1986
martensi	1	female	Hainan Island	Sept., 1985

Table 2. Chromosome measurements of *Occidozyga* from China.

Chromosome Number	*lima* (Xishuangbanna)		*martensi* (Xishuangbanna)		*martensi* (Hainan)	
	Relative Length	Arm Ratio	Relative Length	Arm Ratio	Relative Length	Arm Ratio
1	14.31±0.45	1.28±0.04	15.68±0.73	1.15±0.06	14.39±0.57	1.10±0.06
2	12.06±0.48	1.74±0.17	12.78±0.69	1.56±0.14	12.35±0.62	1.53±0.11
3	11.20±0.36	1.91±0.14	11.33±0.69	2.19±0.13	10.92±0.29	2.20±0.15
4	10.28±0.45	1.64±0.11	10.76±0.48	1.57±0.15	10.30±0.42	1.59±0.15
5	9.58±0.52	1.23±0.12	9.42±0.39	1.31±0.12	9.31±0.46	1.28±0.09
6	6.52±0.39	1.18±0.12	6.21±0.39	1.29±0.13	6.52±0.26	1.14±0.07
7	6.09±0.28	1.15±0.11	5.79±0.30	1.37±0.17	6.06±0.15	1.17±0.07
8	5.75±0.40	1.97±0.20	5.58±0.34	2.55±0.39	5.87±0.29	2.41±0.23
9	5.44±0.35	1.90±0.19	5.20±0.37	2.58±0.43	5.45±0.22	2.32±0.38
10	5.19±0.35	1.19±0.09	4.82±0.30	2.30±0.35	5.08±0.27	1.98±0.20
11	4.92±0.35	1.22±0.12	4.51±0.34	1.30±0.16	4.93±0.21	1.29±0.10
12	4.54±0.38	1.30±0.13	4.23±0.31	1.36±0.20	4.71±0.22	1.40±0.17
13	4.11±0.26	1.39±0.12	3.70±0.38	3.07±0.70	4.11±0.30	2.42±0.36

Table 3. The centromeric type of chromosomes of four populations of the genus *Occidozyga*.

Taxon (Locality)	Centromeric Type												
	1	2	3	4	5	6	7	8	9	10	11	12	13
lima (Xishuangbanna)	m	sm	sm	m	m	m	m	sm	sm	m	m	m	m
martensi (Xishuangbanna)	m	m	sm	m	m	m	m	sm	sm	sm	m	m	st/sm
martensi (Hainan)	m	m	sm	m	m	m	m	sm	sm	sm	m	m	sm
laevis (the Philippines)	m	m	sm	m	m	m	m	m	m	m	m	m	m

Liu and Hu (1959) from Xishuang Banna, southern Yunnan. These authors, as well as other workers, who deal with the amphibian fauna of China in recent years, identified *martensi* specimens with *O. laevis* or its subspecies *O. l. martensi*. However, the characteristics of *martensi* are much different from those of *O. laevis*. For example, *laevis* has a disc beneath each toe-tip and a distinct longitudinal groove on the upper surface; the toe-tip in *martensi* only appears as a small swollen ball-like structure or a very indistinct disc, and it has no dorsal longitudinal groove. Moreover, the snout-vent length of *laevis* (48-49mm) is much greater than that of *martensi* (20-30mm). Therefore, they are in fact different species as listed in "Amphibian Species of the World" (Ed. Frost, 1985:464-465).

Kuramoto(1980)reported the karyotype of *O. laevis* from Binangonan, the Philippines, with a diploid number, 2n=26, comprising five large and eight small pairs. This is quite similar to our results using Chinese *O. lima* and the taxon *martensi*. In *laevis*, all the chromosomes except No. 3, which is submetacentric, are metacentric. This, however, is much different from the cases in *O. lima* and the taxon *martensi*.

Based on karyotypic materials of the four populations of three species in the genus *Occidozyga*, the phylogenetic relationship may be illustrated as figure 1.

It is therefore very clear, as shown in table 3 and figure 1, that the differences in the centromeric type of their chromosomes are prominent between *O. laevis* and the taxon *martensi*.

Conclusion

On basis of karyotypic and morphological characteristics, the taxon *martensi* should be regarded as a valid species. The name *Occidozyga laevis martensi* (Peters), formerly used for the specimens of the taxon *martensi* collected from Hainan Island, Guangxi and Yunnan, should be revised to *Occidozyga martensi* (Peters).

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中国产浮蛙属的染色体组型，兼论中国产圆舌浮蛙的分类地位

（图版Ⅰ）

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摘　要

中国产尖舌浮蛙和圆舌浮蛙的二倍染色体数2n=26，由5对大型与8对小型染色体组成。尖舌浮蛙的第2-3，8-9对染色体为亚中着丝粒型，其余各对为中部着丝粒型。圆舌浮蛙第3，8-10，13对为亚中着丝粒型，其余各对为中部着丝粒型。基于中国产圆舌浮蛙与菲律宾产*O. laevis*在外部形态上的差异，在核型上也有多对染色体的着丝粒类型不同。因此，本文认为，中国产圆舌浮蛙不是菲律宾产*O. laevis* (Günther)的亚种，而是一个种级阶元，即*Occidozyga martensi* (Peters)。同时，本文也初步探讨了上述3种浮蛙共4个居群的系统发生关系。

This article was read by the senior author at the united annual meetings of SSAR and CHNM held at Veracrus, Mexico 10-14 August, 1987

本所储义诊、曾晓茂二同志参加了云南西双版纳的野外标本采集工作，特以致谢！

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A RARE CASE OF KARYOTYPE IN ANURA—A PRELIMINARY STUDY ON THE KARYOTYPE OF Philautus doriae (Boulenger) WITH DIFFERENT DIPLOID NUMBERS OF 26 AND 16

(Plate Ⅱ)

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In recent years the studies of the chromosomes of amphibians have been used as a useful method for the solution of some taxonomic and genetic problems. The discovery of more and more exceptional karyotypes has in turn raised new problems in cytogenetics awaiting scientists' answers. Schmid (1980, 1983) reported two species in Anura with highly developed XX/XY and ZZ/ZW sex chromosomes. Liu Wanguo et al. (1984) and Wu Guanfu et al. (1984) reported several species of Anura that have exceptional karyotypes, e.g. the karyotype of *Rana phrynoides* consisting of 64 telocentric microchromosomes; the presence of heteromorphic pairs of chromosomes (XX/XY) in *Amolops mantzorum*; and the occurence of different diploid numbers, 2n=26 (male) and 2n=27 (female) in *Amolops jingjiangensis*. In the studies of the karyotypes of pelobatids found in the Hengduan Mountains, another type of karyotypic polymorphism with 2n=26, 27 and 28 in *Brachytarsophrys carinensis* has been discovered (Tan et al., 1987, Acta Herpetologica Sinica 6(2)). The karyotype of *Philautus doriae* now under discussion is unique to this field.

Material and Method

Chromosome preparations and karyotype analysis were made after Wu (1980) and Tan et al. (1986), using 7 females and 1 male of *Philautus doriae* captured from Youle Mountain, Xishuangbanna, Yunnan on June 6, 1986 at the altitude of 1,100 m above sea level. Student's t-tests were then followed to testify the significance of difference.

Results

The frequency of different diploid numbers of the 8 specimens examined is presented in Table 1. The frequency of 2n=16 (86.93%) is much higher than that of 26 (13.07%).

Table 1. The diploid numbers and frequencies of the 8 specimens examined of *Philautus doriae*

No	Sex	2n=26*	2n=16
1	♂	6	11
2	♂	0	26
3	♂	1	7
4	♂	2	10
5	♂	0	35
6	♂	0	23
7	♂	1	7
8	♀	10	14
Total	cells	observed	
		20	133
Frequencies			
		13.07%	86.93%

* 2n=26 includes 2n=23(3), 2n=24(1) and 2n=25(1).

The statistical data for the two different karyotypes are tabulated in Table 2. The karyotype with 2n=26 is composed of 5 pairs of macro- (R.L.>9%) and 8 pairs of microchromosomes (R. L.<7%). Among these chromosomes, Nos. 1 and 4 are metacentric or submetacentric, Nos. 2-3 are submetacentric, and the rest are metacentric. This is quite similar to the case in other species of Rhacophoridae having the same diploid number. The karyotype with 2n=16 has never been described in rhacophorid frogs, even in Anura. In the case examined, all the 8 pairs of chromosomes are larger ones (R.L.>9%), among which Nos 5-6 are submetacentric and the rest are metacentric (Plate Ⅱ, Table 2). No heteromorphic chromosomes are observed.

Analysis and Discussion

Preliminary analysis shows that there seems to be a possibility of relationship between the two karyotypes. Despite the apparent differences in chromosome number and morphology, the first five pairs of macrochromosomes in the karyotype with a diploid number of 26 correspond with Nos. 2,4-6, and 8 in the other karyotype, except that the arm ratio of No. 2 in the karyotype of 2n=26 differs significantly from that of No. 4 in the other karyotype. In addition, the total relative length of Nos. 6-13 (41.96±2.49) is similar to that of Nos. 1, 3, and 7 (40.01±1.32) of the latter, implying that the two karyotypes may be homogeneous in origin. Further evidence for the homogeny of the karyotypes may be given by determining the DNA

Table 2. The two kinds of karyotypes of *Philautus doriae* (Boulenger)♂♂, (10 Cells)

2n=26				2n=16			
No.	Relative length	Arm ratio	Type	No.	Relative length	Arm ratio	Type
				1	15.92±0.65	1.45±0.12	m
1	14.34±0.68	1.68±0.11	m,sm	2	14.60±0.55	1.51±0.11	m
				3	13.54±0.44	1.24±0.13	m
2	12.11±0.54	1.78±0.21	sm	4	12.62±0.61	1.20±0.06	m
3	11.54±0.58	1.90±0.13	sm	5	11.90±0.57	2.00±0.11	sm
4	10.67±0.39	1.61±0.11	m,sm	6	10.89±0.38	1.82±0.10	sm
				7	10.55±0.23	1.13±0.11	m
5	9.59±0.54	1.35±0.13	m	8	9.83±0.44	1.11±0.06	m
6	6.77±0.38	1.57±0.10	m				
7	6.02±0.33	1.46±0.15	m				
8	5.58±0.28	1.30±0.13	m				
9	5.48±0.28	1.32±0.14	m				
10	5.03±0.30	1.31±0.17	m				
11	4.68±0.34	1.19±0.11	m				
12*	4.41±0.23	1.20±0.17	m				
13	3.99±0.35	1.15±0.07	m				

* Chromosome with satellite at the terminal of the long arm.

Table 3. Statistical analysis of the relationship between the two karyotypes

2n=26 no.	2n=16 no.	t-value between relative lengths	t-value between arm ratios
1	2	0.30	1.09
2	4	0.63	2.66*
3	5	0.44	0.59
4	6	0.40	1.41
5	8	0.17	1.68
6-13	1,3,7	0.47	

* differs significantly ($0.01<P<0.05$); the others differ insignificantly ($P>0.05$).

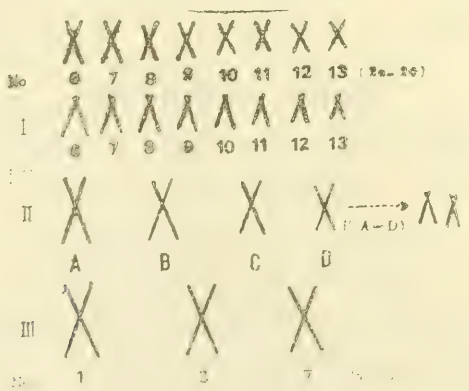

Fig 1. Presumed karyotype changes from 2n=26 to 2n=16
Stage I Pericentric inversion
Stage II Robertsonian fussion and fission
Stage III Random translocation and rearrangement

content cytochemically in future researches.

In the karyotypic evolution of anurans, there is a tendency of decrease in chromosome number, increase in chromosome size and transformation of centromeric position from telocentric to metacentric (Morescalchi, 1973). Chromosomes 1, 3, and 7 in the karyotype with 2n=16 of *P. doriae* may have evolved from the 8 pairs of microchromosomes in the karyotype with 2n=26 by breakage, inversion and recombination. An assumption of the evolutionary changes concerned is illustrated in Fig. 1.

The fact that there are two different karyotypes of this species constitutes a new problem in cytology and genetics. It is worth investigating how two different karyotypes can occur in an individual and what the genetic mechanism of this organism is. However, the actual existence of two different karyotypes in *P. doriae* implys that they probably have certain potential advantages so that they are retained to form an intraspecific karyotypic polymorphism, which may be relative to adaptation to environment and differentiation of organism.

The genus *Philautus* are mainly distributed over Southeast Asia. In China can be found 10 species of this genus (Tian et al., 1986). This paper reports for the first time on the karyotype of a species of the genus. Further studies on the karyotypes of other species will help to clarify the karyotypic polymorphism in *P. doriae* as well as the effect of chromosome changes on the differentiation of this species.

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一种罕见的无尾类染色体组型——对具有二倍数为26和16的背条小树蛙的初步研究

（图版Ⅱ）

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摘 要

在树蛙科核型研究中，发现背条小树蛙同一种内具有2n=26 和 2n=16 两种核型。初步认为这两种核型间可能存在一定的联系。2n=26的核型由 5 对大型、8 对小型染色体组成；2n=16 的核型全由8对大型染色体组成。从相对长度和臂比指数看，2n=26 核型中 nos.1-5 对染色体分别相当于2n=16核型中nos.2,4,5,6,8对染色体；前者nos.6-13 对与后者 nos.1, 3,7对染色体的相对长度基本一致。文章认为，2n=16可能由2n=26 的核型演化而成，两种核型共存可能是背条小树蛙的一种核型多型性。

本所储义珍、曾晓茂二同志参加了云南西双版纳的野外标本采集工作，特此致谢！

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KARYOTYPES OF SOME SPECIES OF THE GENUS Bungarus

(Plates III-V)

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INTRODUCTION

The karyotypes of several species of the elapid genus *Bungarus* were investigated by several previous workers: *B. multicinctus* by Nakamura (1935) and Qu et al. (1981); *B. caeruleus* by Bhatnagar (1960) and Singh et al (1970); and *B. fasciatus* by Singh (1974). In the present study, the karyotypes of *B. multicinctus* and *B. fasciatus* were re-examined and that of *B. candidus* is examined for the first time. Some interesting features, which were not mentioned by previous workers, were observed in them. It is the purpose of this article to document them.

MATERIALS AND METHODS

The snakes used in this study are:

B. multicinctus Blyth, two females from Taiwan

B. candidus (Linnaeus), a male from Thailand

B. fasciatus (Schneider), a female from southern China and a female from Thailand.

All these snakes were obtained via some animal dealers and do not bear precise localities. *B. multicinctus* was provided by the Japan Snake Institute, *B. candidus* and *B. fasciatus* from Thailand were by Mr. H. Sugano, and *B. fasciatus* from southern China was obtained by the courtesy of Mr. C. S. Tseng.

The chromosomes were observed from the direct preparations of the bone marrow cells of ribs using the slightly modified techniques described by Yosida and Toriba (1986). (1) 6-8ml/kg (body weight) of 0.005% (w/v) colchicine were injected in the peritoneal cavity. (2) Six to eight hours later the snake was anesthetized and 8 to 10 ribs were cut off. (3) The bone marrow cells were removed to centrifuge tube from the shaft of the bone in the Dulbecco's physiological buffer solution (PBS) by use of syringe. (4) The suspension was centrifuged at 1200 rpm for 5 min, after that the PBS was discarded. (5) About 3 ml of the hypotonic

solution, 1% (w/v) sodium citrate, was added to the tube and suspended by pipette. (6) The suspension was left for 10 min in the room temperature. (7) Five ml of Carnoy 3:1 (absolute alcohol 3: gracial acetic acid 1) solution were added to the tube and mixed with the hypotonic solution, and left for 2 to 3 min. (8) The suspension was centrifuged and the solution was discarded. (9) Three to four ml of the Carnoy solution was added and left for 2 to 3 min. (10) After another centrifugalization, about 0.2 ml of Carnoy solution were added. (11) A drop of the fixed material was placed on a wet slide glass kept in 50% alcohol, dried quickly over a gas flame, and stained with 4% Giemsa solution.

The measurement of chromosomes were made from 10 good metaphase plates from each snake. The centromeric positions are classified following Levan et al. (1964).

RESULTS

Bungarus multicinctus: The diploid number was 2n=36. 22 macro- and 14 microchromosomes are distinguished (Plate Ⅲ). The fourth largest pair was heteromorphic and considered as sex chromosomes. The relative length and centromeric indices of macrochromosomes are shown in Table 1. Biarmed chromosomes were only no. 1 and Z-. A prominent secondary constriction was seen in the chromosomes of pair no. 2. Although less prominent, another secondary constriction was recognized at the tip of longer arm of no. 1 chromosome pair. Meta- or submetacentric chromosomes were not recognized in microchromosomes.

Bungarus candidus: The diploid number was 2n=36. There were 22 macro- and 14 microchromosomes (Plate Ⅳ). The relative length and centromeric indices of macrochromosomes are shown in Table 1. As seen in figures and table, the karyotype of this species was similar to that of *B. multicinctus*. The secondary constrictions were also seen in similar position of pair nos. 1 and 2.

Bungarus fasciatus: The diploid number was 2n=38. There were 18 macro- and 20 microchromosomes (Plate Ⅴ). The relative length and centromeric indices of macrochromosomes are shown in Table 2. The largest three pairs were meta- or submetacentric and other autosomes were telocentric. The fourth largest pair was heteromorphic and regarded as sex chromosomes. Judged from the study by Singh (1974), larger metacentric chromosome was considered as Z-, and smaller one was considered as W-chromosome. W-chromosome was metacentric and different from that of the specimen in India. A prominent secondary constriction was seen in pair no. 1. Another less prominent secondary constriction can be detected at the tip of longer arm of no. 2 chromosome pair. This secondary constriction could be seen only in some plates and could not be detected in other plates. These descriptions were made from the karyotypes of the specimen of Southern China. The specimen from Thailand indicated almost the same features.

DISCUSSION

The similarity in karyotypes of *B. multicinctus* and *B. candidus* suggests their close relationship (see Table 3). They are unique in having only 7 pairs of microchromosomes. In macrochromosomes, their number of arms is 22 and identical with that of *B. fasciatus*. Although *B. caeruleus* has different number of macroautosomal arms, Singh (1974) indicated the correspondence of macrochromosomes between *B. fasciatus* and *caeruleus*. Similar, but more simple, relationship in macrochromosomes can be seen between *B. multicinctus* (or *B. candidus*) and *B. fasciatus*. The lost pairs of microchromosomes in *B. multicinctus* and *candidus* may be fused to some telocentric macrochromosomes.

The results on karyotype of *B. multicinctus* in the present study well agree with those of Qu et al. (1981) except the secondary constrictions. Because the prominent secondary constriction has been known in *B. caeruleus* and *B.* fasciatus, it is not surprising to find it in *B. multicinctus* and *B. candidus*. And the lack of the information on it in the study of Qu et al. (1981) may have been due to the condition of preparation of samples. Another less prominent secondary constriction is found for the first time in the genus *Bungarus*. Future examination may reveal the presence of this feature in the chromosome of *B. caeruleus*.

W-chromosome of *B. fasciatus* was reported as telocentric by Singh (1974) based on the specimens from Madras and Calcutta, India. This chromosome was found to be metacentric in the present study based on the specimens from Thailand and southern China. This evidence suggests a geographic variation in the centromeric position of W-chromosome of this species. Such a intraspecific variation of W-chromosome of snakes is rather rare, although it is variable among species. Recently Ma (1986) reported the geographic variation of W-chromosome of *Rhabdophis tigrinus*. Future study on the species with large distributional range may find much more additional cases.

SUMMARY

Karyotypes of three species of the genus *Bungarus* is described. The karyotype of *B. candidus* is similar to *B. multicinctus* and their close relationship is suggested. All three species have two kinds of secondary constriction in the homologous position. W-chromosome of *B. fasciatus* indicates a geographic variation, telocentric in India and metacentric in Thailand and China.

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Table 1. Measurements of the chromosomes of a female *B. multicinctus* and a male *B. candidus*.

	B. multicinctus		*B. candidus*		Position of centromere
No.	RL	CI	RL	CI	
1.	22.03±1.04	34.21±2.74	21.85±1.18	35.16±2.29	sm
2.	14.40±0.78	8.72±2.39	14.47±0.55	10.30±1.27	t
3.	14.22±0.97	9.84±1.00	13.41±0.48	12.15±1.79	t
4.	9.45±0.52	14.53±2.08	9.04±0.52	19.07±1.93	st
5.	6.85±0.34	0	6.74±0.36	0	t
6.	6.05±0.46	0	6.24±0.23	0	t
7.	5.24±0.32	0	5.61±0.27	0	t
8.	4.57±0.42	0	4.71±0.39	0	t
9.	3.78±0.43	0	3.94±0.32	0	t
10.	3.01±0.44	0	3.27±0.35	0	t
z.	10.41±0.73	28.91±2.67	10.72±0.66	30.20±1.84	sm
w.	9.64±1.19	12.92±2.89			st

RL: relative length, CI: centromeric index. They are given in the mean and one standard deviation.

Table 2. Measurements of the chromosomes of a female *B. fasciatus* from southern China.

	RL	CI	position of centromere
1.	27.06±1.05	47.14±1.32	m
2.	22.27±0.80	35.07±2.40	sm
3.	14.81±0.57	45.39±1.25	m
4.	6.96±0.44	0	t
5.	5.54±0.30	0	t
6.	5.11±0.27	0	t
7.	4.11±0.36	0	t
8.	3.66±0.28	0	t
z.	10.48±0.83	47.52±1.73	m
w.	7.97±0.56	46.02±1.99	m

Abbreviations are the same as in Table 1.

Table 3. Chromosomes of four species of the genus *Bungarus*.

		number of autosomal		number of macroautosomal	
	2n	macros	micros	arms	sex
B. multicinctus	36	20	14	22	ZW
B. candidus	36	20	14	22	?
B. caeruleus[1]	44(♀43)	20	20	20	Z_1Z_1W
B. fasciatus	38	16	20	22	ZW[2]

1) Singh et al. (1970).
2) W-chromosome varies geographically.

几 种 环 蛇 的 染 色 体 组 型

(图版Ⅲ-Ⅴ)

鸟羽通久
(日本蛇类研究所)

摘 要

作者首次报道了产自泰国的 *Bungarus candidus* 的染色体组型，并观察了前人已报道的 *B. multicinctus* (产地：中国台湾) 和 *B. fasciatus* (产地：中国南部和泰国) 二种蛇的染色体组型。讨论了前人尚未提及的某些重要特征。*B. candidus* 和 *B. multicinctus* 的染色体组型相似，提示其亲缘关系较近。这三种蛇均在第 1 和第 2 染色体的相应位置发现次缢痕。产自印度的 *B. fasciatus* 的 W-染色体为端部着丝而产自泰国和中国的为中部着丝，表明存在地理差异。

Chinese Herpetol. Res. 1987:22-59

Reptiles of the Democratic People's Republic of Korea. Part I. Serpentes

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Abstract.-This paper presents morphological descriptions, notes on distribution and natural history of North Korean snakes. The territory of North Korea (Democratic People's Republic of Korea) is inhabited by 14 ophidian species: *Coluber spinalis, Dinodon rufozonatum rufozonatum, Elaphe davidi, E. dione, E. rufodorsata, E. schrenckii schrenckii* and *E. schrenckii anomala, Amphiesma vibakari ruthveni, Rhabdophis tigrinus* (Colubridae s. l.), *Hydrophis cyanocinctus, H. melanocephalus* (Hydrophiidae), *Vipera berus berus, Agkistrodon blomhoffii brevicaudus, A. caliginosus, A. saxatalis* (Viperidae). Three other species,(†)*Sibynophis chinensis* and *Pelamis Platurus*, recorded from South Korea, as well as *Elaphe taeniura taeniura*, recently not reported from the Korean Peninsula, are also discussed. The systematic account is supplemented with distributional maps and a key for identification of the Korean snakes.

Introduction

In the present article we attempt to summarize the current knowledge on the reptile fauna of the Democratic People's Republic of Korea (abbr. DPRK, often named North Korea), with special reference to its geographical distribution. This summary is on the whole based on available literature concerning this country and on studies of the herpetological collection belonging to the Zoological Institute of the Academy of Sciences of DPRK in Pyongyang (abbr. ZIP). The ZIP collection, including 283 specimens of reptiles, has been gathered by the staff of the Zoologi-

(*) 어흥담

cal Institute since the early 1960s. A part of the collection was probably described in the monograph on Korean herpetofauna by Won (1971). Unfortunately, before 1984 the reptiles belonging to this collection were not catalogued; in most cases we found it impossible to determine which specimens were described in Won's book. Other reptiles, used for descriptions in the present paper, were collected by field parties from the Institute of Systematic and Experimental Zoology of the Polish Academy of Sciences in Cracow during works in North Korea during the 1980s (abbr. ZZSiD).

This paper is devoted to snakes. Thus far, 17 species have been reported from the whole Korean Peninsula, Cheju Island and surrounding sea waters. Of this number, the presence of 14 species, including two sea snakes, has been determined with certainty from the territory of North Korea. Another article, dealing with turtles and lizards, and supplemented by zoogeographical discussions, will be published in the near future.

Literature review

The present knowledge on the herpetofauna of North Korea is rather limited. Classical descriptions of the Korean reptiles, included in the monographs of Stejneger (1907) and Maki (1931), dealt almost exclusively with the southern part of the Korean Peninsula (South Korea). Some other minor pre-war publications, mainly by Japanese students, did not contribute much to the survey of North Korean reptiles. Immediately after the Korean War, as a result of the accumulation of herpetological specimens collected by members of the American armed forces, a number of articles were published in the United States in the 1950s. Of these publications, only that of Shannon (1956) presented much data concerning the northern half of the Korean Peninsula; the others concentrated on South Korean localities only. Up to the present, Shannon's article has been the only essential source of information in English on the distribution of the North Korean herpetofauna. Subsequent important contributions of American herpetologists, partly based on North Korean materials, include revisions of the snake genera *Amphiesma* and *Agkistrodon* by Malnate (1962) and Gloyd (1972), respectively.

In the late 1950s, North Koreans themselves began contributing to the herpetological studies of their country. Probably the first publication was a list of the Korean animals, edited by the late Won Hong Koo, long-time director of the Zoological Institute in Pyongyang. Unfortunately, the reptile section of this book, issued in 1956, was incomplete and contained many errors. A similar list, slightly improved, was published later by Won and Choy in 1967. The number of original articles published in North Korea is very small; only four papers dealing with reptiles have been traced in "Saeng-mul" (=J. Biol. Sci.) and "Kwahangwon Tongbo" (= Bull. Acad. Sci. DPRK), the only North Korean journals devoted

to the biological sciences. These articles are: Tong and Yon (1961), Song (1961), Choi (1963), and Li (1970). No doubt, the most important item among North Korean herpetological literature is Won's (1971) monograph of the amphibians and reptiles of Korea. Among other things, this book contains a lot of valuable observations of living reptiles made in the field and in the Pyongyang Zoo; they are widely cited in the present paper. Unfortunately, probably none of these publications, written in Korean, is familiar to zoologists from beyond North Korea.

Since the early 1960s, as the result of the exploration of North Korean territory by Polish zoologists, a number of articles (usually written in English) devoted to various groups of animals were issued in Poland. In the field of herpetology, two papers were recently published by Szyndlar (1984, 1985).

Localities

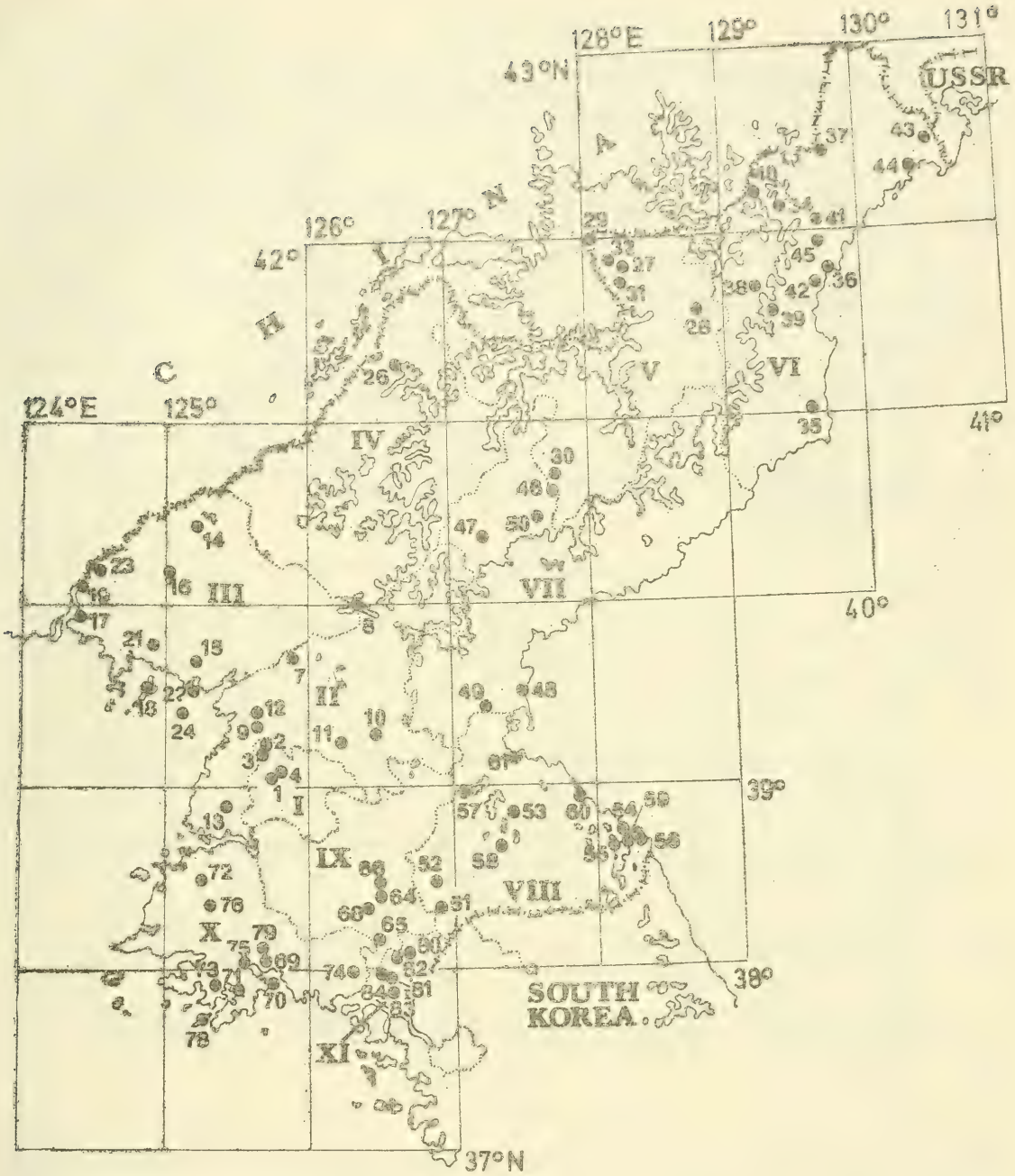
Eighty-four localities for snakes, lizards and turtles are mapped in Fig. 1. Names of these sites, accompanied by geographic coordinates, are listed in the Gazetteer. The political subdivision and present names were taken from the "Administrative Map of Korea" (1:1,100,000) issued by the Kwahak, Paek Kwasajon Chulpansa (Pyongyang, 1983). Spelling used in this paper follows the system of Romanization employed in the English version of the "Map of Korea" (1:1,500,000) published by the Foreign Languages Publishing House (Pyongyang, 1976). Shannon (1956), followed by Gloyd (1972), pointed out problems in correct allocation of Korean localities, because of use in the literature of numerous synonymous names. Unfortunately, Shannon himself mistook the location of several North Korean sites for other ones (Shannon, 1956: Fig. 1). For example, he correctly mapped the well-known locality Musan Pass, i.e., on the river Tuman-gang in the North Hamgyong Province, but in the text (Shannon, 1956:25) placed this site on the Yalu River (=Amnok-gang). Also Gloyd (1972:573) committed a similar error, placing the same locality in the Ryanggang Province, again on the Yalu River; on his Map 1, Musan is situated in the area of Hyesan, the capital of the Ryanggang Province. In order to avoid any misunderstanding, in the Gazetteer we place all older synonyms or different spellings, if used by previous students. On request, the senior author can provide a list of the locality names written in the Korean alphabet.

Systematic account

References in the synonymy are made only to original descriptions and to works concerning the Korean territory (including South Korea).

Geographic ranges cover the whole distribution of the species, including subspecies not occurring in Korea.

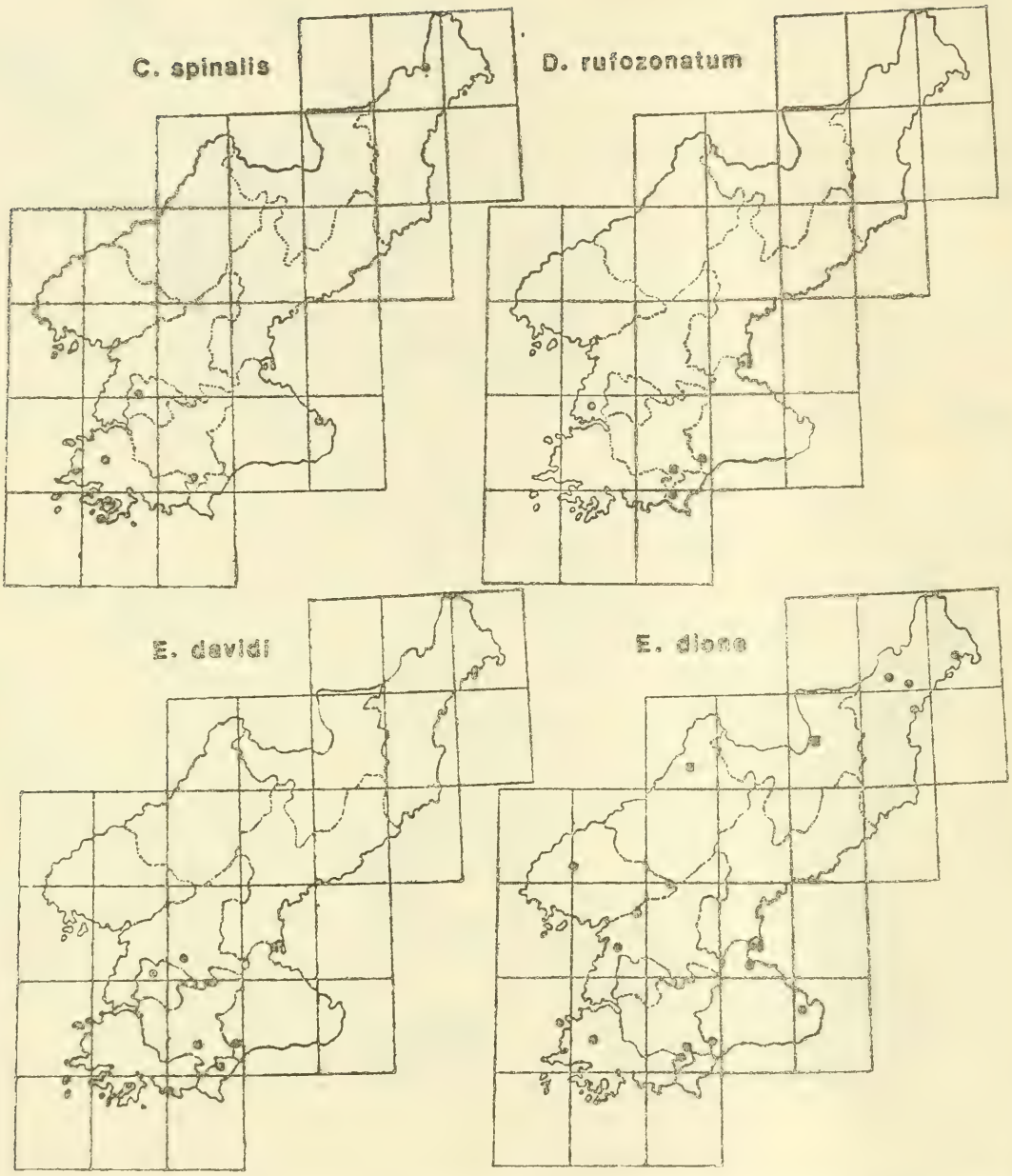
Localities in North Korea (DPRK) are either taken from the literature or are



based on the examined material. The localities are marked on the accompanying maps (Figs 2-4): circles represent sites of known coordinates (cf. Fig. 1), squares indicate approximate location of sites of unknown coordinates. Numbers, preceding the name of each locality, correspond with those in the Gazetteer.

Short morphological descriptions of the ZIP and ZZSiD specimens are compared with data from other publications devoted to Korea (including South Korea). More detailed description of the Korean snakes can be found in Stejneger (1907) and Pope (1935).

Data on habitat and habits are restricted to observations made in Korea (in-



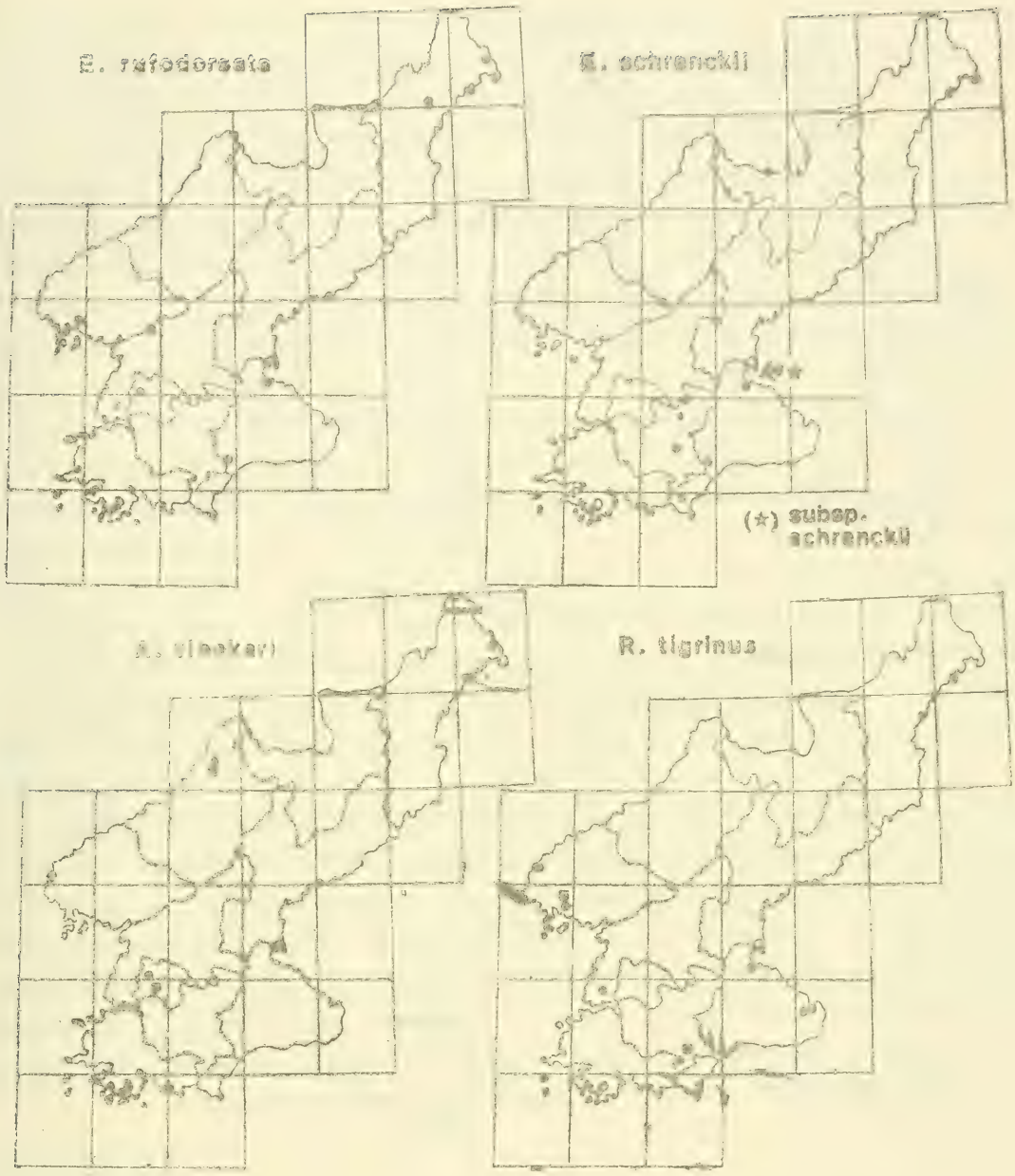
cluding South Korea). Further information on the natural history of most snakes inhabiting Korea can be found in the work of Pope (1935); of the literature written in English it is still the best and most comprehensive study of the East Asiatic herpetofauna.

Remarks touching on taxonomic, or other important, problems are added when necessary.

Family Colubridae sensu lato

Coluber spinalis (Peters, 1866)

Masticophis spinalis Peters, 1866, Monatsber Akad. Wiss. Berlin, p. 91 (type

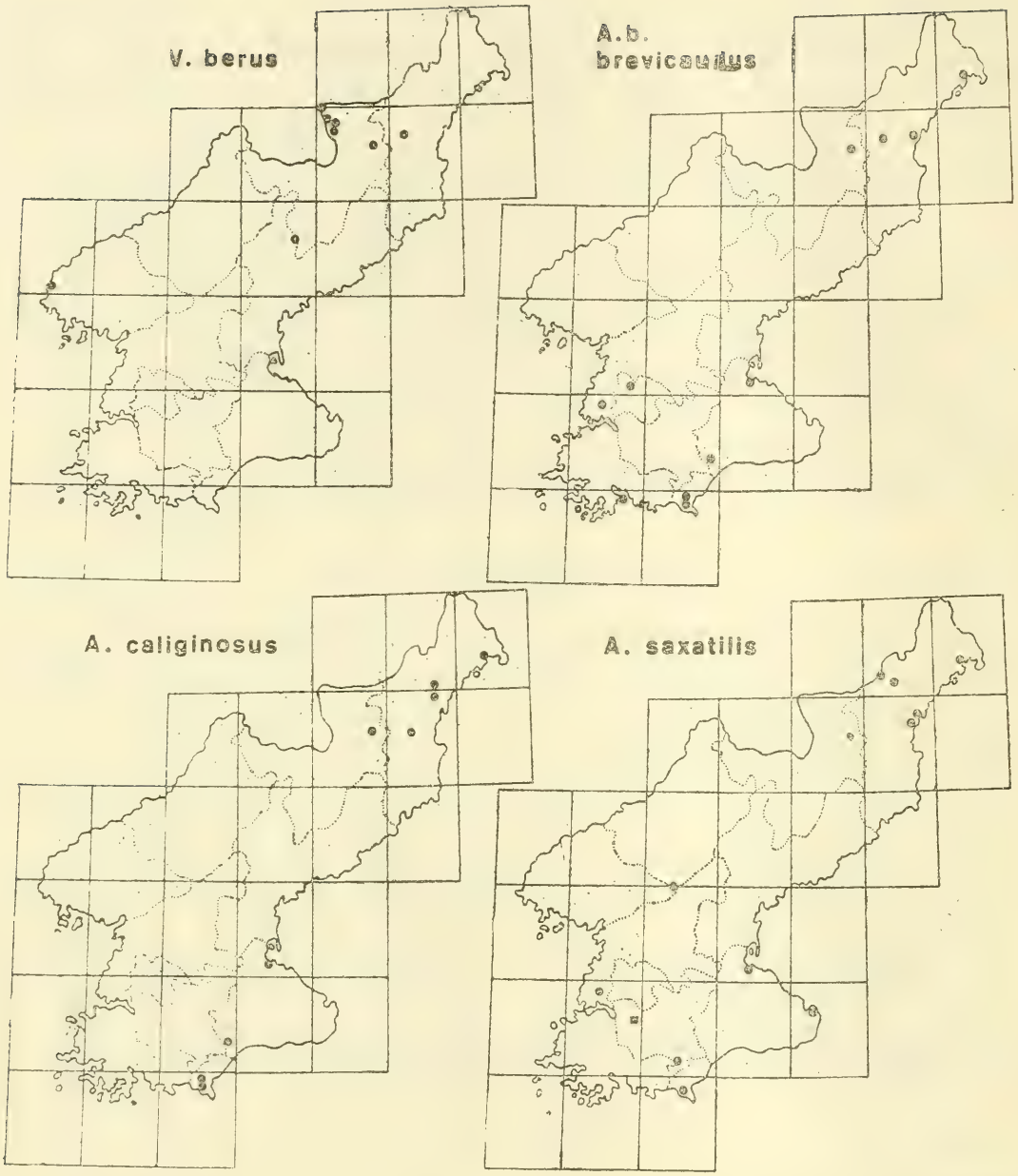


locality: "Mexico").

Zamenis spinalis. - Guenther, 1872, Ann. Mag. Nat. Hist., (4), 9:22. - Stejneger, 1907, Herp. Japan, p. 349. - Mori, 1928, J. Chosen Nat. Hist. Soc.,6:50.- Maki, 1931, Monogr. snakes Japan, p. 76. - Shannon, 1956, Herpetologica, 12: 44.- Dixon, 1956, Herpetologica, 12:55. - Webb et al., 1962, Univ. Kansas Publ. Mus. Nat. Hist., 15:166. - Kang and Yoon, 1975, Encycl. fauna flora Korea, 17:155. - Paik, 1982, Syst. stud. Serp. Korea, p. 60.

Coluber spinalis.-Slevin, 1925, Proc. Calif. Acad. Sci., (4), 14:98.-Babb, 1955, Philad. Herp. Soc. Bull., 1:21.-Won, 1971, Amph. rept. fauna Korea, p.129.

Range.-North Korea, South Korea including Cheju Island (Paik, 1982).



northern half of China (An Illustrated Monograph of the Snakes of China, 1980), southern and central Mongolia (Bannikov, 1958), easternmost Kazakhstan in the USSR (Bannikov et al., 1977). Its presumed presence in the Soviet Far East is uncertain. Early records from Thailand are certainly erroneous (Pope, 1935).

Distribution in DPRK (Fig. 2).-Ⅰ. Pyongyang City; 1. Pyongyang (Shannon, 1956:44).-Ⅵ. North Hamgyong Province; 37. Hoeryong (Shannon, 1956:44).-Ⅷ. Kangwon Province; 54. Kosong (Won, 1971:131).-Ⅸ. North Hwanghae Province; 65. Kumchon (ZIP 59).-Ⅹ. South Hwanghae Province; 73. Ongjin (Won, 1971:131), 76. Samchon (ZIP 16), 78. Sunwi-do (Won, 1971:131; ZIP 4).

Description.-Two males (ZIP 4 and 16), ventrals 190 and 204, subcaudals 88 and 89, snout-vent length 460 mm and 610mm, tail length 180mm and 200mm. One female (ZIP 59), ventrals 208, subcaudals 90, snout-vent length 570mm, tail length 190mm. Anal divided. Scales smooth, in 17-15-15 rows in the males, 17-17-15 in the female. Preoculars 2, postoculars 2, temporals 2+2, upper labials 8, upper labials entering eye 4 and 5, lower labials 9 or 10. Dorsum brown with a light-yellow longitudinal band extending from the frontal to near the tail tip.

The examined material generally resembles those *Coluber spinalis* hitherto reported from Korea except for the number of dorsal scales-in previously described specimens the scale row at midbody is always 17. Korean *Coluber spinalis* reported by Stejneger (1907), Slevin (1925), Maki (1931), Dixon (1956), Shannon (1956), Webb et al. (1962), and Won (1971) have 184-203 ventrals in males and 194-209 in females, 82-102 and 77-96, subcaudals respectively. These data suggest that females usually have more ventrals than do males. Only Paik (1982) reports four females from South Korea with an exceptionally low number of ventrals, i. e., 186-189. Preoculars always 2; postoculars always 2; temporals 2+2, sometimes 2+3; upper labials always 8; lower labials 9, 10 or 11. Unlike other authors, Won (1971) noted a male and a female with undivided anals. The largest individual reported from the Korean Peninsula is a female with a total length of 904mm (Shannon, 1956).

Habitat and habits.-In Korea *Coluber spinalis* has been found in various types of habitat including grasses and shrubs on hillsides or high dry valleys (Shannon, 1956; Won, 1971), wooded rocky areas (Dixon, 1956), mountain ridges (Babb, 1955), and also grasses near streams (Webb et al., 1962). It feeds on lizards (Won, 1971), mice (Shannon, 1956) and even small snakes (Webb et al., 1962). *Coluber spinalis* moves with considerable speed (Shannon, 1956; Won, 1971). One gravid female contained six eggs, each ca. 35mm in length (Webb et al., 1962).

Dinodon rufozonatum rufozonatum (Cantor, 1842)

Lycodon rufo-zonatus Cantor, 1842, Ann. Mag. Nat. Hist., 9:483 (type locality: Chusan Island, China).

Dinodon rufozonatus.-Peters, 1881, Sitz. Ber. Ges. Naturf. Freunde Berlin, p.89. *Dinodon rufozonatum*.-Stejneger, 1907, Herp. Japan, p.358.-Slevin, 1925, Proc. Calif. Acad. Sci., (4), 14:99.-Shannon, 1956, Herpetologica, 12:43.-Dixon, 1956, Herpetologica, 12:56.-Webb et al., 1962, Univ. Kansas Publ. Mus. Nat. Hist., 15:166. *Dinodon rufozonatum rufozonatum*.-Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., 54:523.-Maki, 1931, Monogr. snakes Japan, p.118.-Babb, 1955, Philad. Herp. Soc. Bull., 1:22.-Won, 1956, List animal names, p.254.-Won, 1971, Amph. rept. fauna Korea, p.129.-Kang and Yoon, 1975, Encycl. fauna flora Korea, 17:153.-Paik, 1982, Syst. stud. Serp. Korea, p.58.

Range.-North Korea, South Korea excluding Cheju Island (Paik, 1982), Tsu-

shima Islands (Nakamura and Uéno, 1969), eastern half of China including Taiwan (An Illustrated Monograph of the Snakes of China, 1980), several islands in the Ryukyu Archipelago (subspecies *walli*) (Nakamura and Uéno, 1969). Its presumed presence in the vicinity of Vladivostok in the USSR is uncertain (Bannikov et al., 1977).

Distribution in DPRK (Fig. 2).-Ⅱ. South Pyongan Province: 13. Taesong-ho (ZIP 99, 115).-Ⅶ. Kangwon Province: 51. Cholwon (Shannon, 1956:43).-Ⅸ. North Hwanghae Province: 67. Paegyang (ZIP 5, 6, 18, 19). -Ⅺ. Kaesong City: 84. Haeson-ri (a shed skin-Szyndlar, personal observation, October 1984).

Description.-Material examined: Three males (ZIP 5, 6 and 19), two females (ZIP 18 and 99), one badly damaged specimen of undetermined sex (ZIP 115). In males, ventrals are 216, 204 and 203, subcaudals 68, 68 and 67, snout-vent length 910, 870 and 730mm, tail length 190, 170 and 140mm, respectively. In females, ventrals are 217 and 212, subcaudals 69 and 77, snout-vent length 610 and 733mm, tail length 150 and 167mm, respectively. Anal undivided. Scales smooth, rows 17 or 19-17 (in one case 19) -15 or 16. Preocular 1, postoculars 2, temporals 2+3, upper labials 8 (in one case 7), upper labials entering eye 3 and 4 or 4 and 5, lower labials 9 (in one case 10). Dorsum black, sometimes dark-brown, with red or orange crossbands throughout its length. Total number of the crossbands ranges from 70 to 92.

Other Korean examples of this snake reported by Shannon (1956), Dixon (1956), Won (1971) and Paik (1982) have 199-207 ventrals and 59-78 subcaudals in males, 197-209 ventrals and 58-75 subcaudals in females. The maximum number of ventrals is therefore lower than in the ZIP specimens. The number of scale rows at midbody is always 17. Preoculars 1 and 2; postoculars 2 (one female examined by Dixon, 1956); temporals 2+2 or 2+3; upper labials usually 8, sometimes 7; lower labials 9, 10 or 11. The largest specimen reported from the Korean Peninsula (sex unknown) has a snout-vent length 965 mm and tail length 205 mm (Won, 1971).

Habitat and habits.-*Dinodon rufozonatum* was collected on the lower slopes of hills or in swampy ground both adjacent to and part of rice fields (Shannon, 1956), also in deep forest among granite outcrops, partly wooded areas (Webb et al., 1962) and on roads (Babb, 1955). According to Won (1971), this snake usually occurs in cultivated areas, but it is very rare in rice fields and mountains. A shed skin of this species was found in a grassy area near a wall surrounding a grave of the king Tongmin near Haeson-ri (Szyndlar, personal observation, 1984). The diet consists of frogs (Shannon, 1956), mice and even toads (Won, 1971). Disappearance for hibernation occurs in October (Won, 1971). No data on breeding habits are available from Korea.

Elaphe davidi (Sauvage, 1884)

Tropidonotus davidi Sauvage, 1884, Bull. Soc. Philom. Paris, (7), 8:144 (type

locality: China).

Elaphe davidi.-Pope, 1935, Rept. China, p.238.-Szyndlar, 1985, Snake, 17:163.

Elaphe dione coreana Song, 1961, Saeng-mul, p.58.

Elaphe coreana.-Won, 1971, Amph. rept. fauna Korea, p.141.

Range. -North Korea and north-eastern provinces of China (An Illustrated Monograph of the Snakes of China, 1980).

Distribution in DPRK (Fig. 2).-Ⅰ. Pyongyang City: 4. Taesong-san (Won, 1971: Table 24; Szyndlar, 1985: Table 1).-Ⅱ. South Pyongan Province: 11. Songchon (Won, 1971: Table 24; Szyndlar, 1985: Table 1).-Ⅲ. Kangwon Province: 51. Cholwon (Song, 1961: 58; Won, 1971: Table 24; Szyndlar, 1985: Table 1).-Ⅳ. North Hwanghae Province: 68. Pyongsan (Won, 1971: Table 24; Szyndlar, 1985: Table 1).-Ⅴ. South Hwanghae Province: 71. Kangryong (Won, 1971: Table 24; Szyndlar, 1985: Table 1).-Ⅵ. Kaesong City: 80. Changpung (Won, 1971: Table 24; Szyndlar, 1985: Table 1).

Description.-One male (ZIP 24), ventrals 172, subcaudals 62, snout-vent length 920 mm, tail length 160 mm. Two females (ZIP 14 and 15), ventrals 178 and 185, subcaudals 59 and 58, snout-vent length 725 and 840 mm, tail length 147 and 180 mm, respectively. Anal divided. Scales heavily keeled, scale rows 24 (or 25)-23-19. Preoculars 2, postoculars 2, temporals 2+2 or 2+3, upper labials 8, upper labials entering eye 4 and 5, lower labials 11 or 12. Dorsum light brown with a middorsal row of dark spots, accompanied by lateral rows of smaller spots.

Habitat and habits.-No data are available from Korea.

Remarks.-This snake was first recorded from Korea by Song (1961), who described it as a new subspecies, *Elaphe dione coreana*. Won (1971) regarded it as a distinct species, *Elaphe coreana*. The true taxonomic status of this form was explained by Szyndlar (1985).

Elaphe dione (Pallas, 1773)

Coluber dione Pallas, 1773, Reise Russ. Reichs, 2:717 (type locality: Gratscheffskoi, ? Kazakhstan).

Elaphe dione.-Stejneger, 1907, Herp. Japan, p.315.-Slevin, 1925, Proc. Calif. Acad. Sci., (4), 14:98.-Mori, 1928, J. Chosen Nat. Hist. Soc., 6:50.-Maki, 1931, Monogr. snakes Japan, p.104. -Tanner, 1953, Great Basin Nat., 13:72.-Steward, 1954, Copeia, p.66.-Babb, 1955, Philad. Herp. Soc. Bull., 1:21.-Shannon, 1956, Herpetologica, 12:44.-Dixon, 1956, Herpetologica, 12:55.-Won, 1956, List animal names, p.254.-Hahn, 1960, J. Ohio Herp. Soc., 2:21.-Webb et al., 1962, Univ. Kansas Publ. Mus. Nat. Hist., 15:167.-Won, 1971, Amph. rept. fauna Korea, p.139.-Kang and Yoon, 1975, Encycl. fauna flora Korea, 17:160.-Paik, 1982, Syst. stud. Serp. Korea, p.57.-Szyndlar, 1984, Acta Zool. Cracov., 27:11.

Range.-North Korea, South Korea including Cheju Island (Paik, 1982), vast

area of central Eurasia from Crimea to the Soviet Far East (Bannikov et al., 1977), the whole territory of Mongolia (Bannikov, 1958), northern half of China (An Illustrated Monograph of the Snakes of China, 1980). Its presumed presence in Iran is uncertain.

Distribution in DPRK (Fig. 2).-II. South Pyongan Province: 7. Kaechon (ZIP 22), 8. Myohyang-san (Szyndlar, 1984:11), 9. Opa (ZIP 23).-III. North Pyongan Province: 16. Chonma-san (ZIP 25).-IV. Chagang Province: 25. Yangcho-ri (Won, 1971:139).-V. Ryanggang Province: 33. Wisupyong (ZIP 76).-VI. North Hamgyong Province: 34. Chayu-ri (Szyndlar, 1984: addendum), 36. Chongjin (Slevin, 1925:98; Shannon, 1956:45), 41. Puryong (Slevin, 1925:98; Shannon, 1956:45), 44. Sanpong (ZIP 121).-VIII. Kangwon Province:51. Cholwon (Shannon,1956:44), 55. Kumgang-san (ZIP 79, 106, 107), 61. Wonsan (Slevin, 1925:98).-IX. North Hwanghae Province: 63. Chesog-san (ZIP 77, 78), 65. Kumchon (ZIP 122).-X. South Hwanghae Province: 76. Samchon (ZIP 17).

Description.-Material examined: 8 males (ZIP 22, 23, 28, 78, 79, 106, 120, ZZSiD 813), 8 females (ZIP 17, 25, 76, 77, 80, 81, 82, ZZSiD 856), and 3 individuals of undetermined sex (ZIP 107, 121, 122). In males, ventrals 183-203 (mean 191.5±7.7), subcaudals 60-75 (mean 68.6±4.5). In females, ventrals 191-205(mean 197.4±4.4), subcaudals 55-68 (mean 62.0±4.4). Largest male 770+190 mm (ZIP 22), largest female 770+160 mm (ZIP 77). Anal divided. Scales smooth. Scale rows usually 25-25-19 (several specimens with 23 at midbody). Preoculars 2, postoculars 2, temporals 2+3 (in one case 2+2), upper labials 8, upper labials entering eye 4 and 5, lower labials 10 (in two cases 11). Dorsum gray, sometimes very dark, with alternating light and dark markings throughout its length.

Specimens of *Elaphe dione* reported from Korea by other authors (Stejneger, 1907; Slevin, 1925; Maki, 1931; Tanner, 1953; Steward, 1954; Shannon, 1956; Dixon, 1956) resemble those described by us. Summary of the features of *Elaphe dione* given by these authors is as follows: ventrals and subcaudals 181-204 and 60-76 in males, 193-212 and 56-71 in females; scale rows at midbody 25, sometimes 23 or 27; preoculars 2, very rarely 1; postoculars 2, exceptionally 3; temporals 2+3, sometimes 2+2 or 2+4; upper labials 8, sometimes 9; lower labials 10 or 11. The number of ventrals and subcaudals, given by Paik (1982) for South Korean examples (males: 188-205 and 64-78, females 187-208 and 56-68), is somewhat different, especially in the case of females. The lowest numbers of ventrals (155 for males and 153 for females) given by Won (1971) are most likely erroneous. The largest specimens reported from Korea are a male 930 mm in total length and a female 1,003 mm (Dixon, 1956). A male reported by Won (1971) as being 770+260 mm long, has a tail that is proportionally too long for *Elaphe dione* and probably represents another species.

Habitat and habits.-*Elaphe dione* is one of the most common snakes in North

Korea. It inhabits various types of country. It was collected among roots and rocks on the summit of a mountain (Steward, 1954), on roads and grassy hillsides (Shannon, 1956), in the water in streams or on the banks of streams (Dixon, 1956), in the vicinity of rice fields (Babb, 1955; Hahn, 1960), on rocky or sparsely wooded hillsides and in cultivated fields (Webb et al., 1962), and among big rocky blocks in open areas (Szyndlar, 1984). According to Won (1971), this snake is common within and adjacent to cultivated areas, but it is rare in the vicinity of rice fields; it hibernates among roots and in graves. *Elaphe dione* feeds on small mammals (Steward, 1954; Dixon, 1956; Webb et al., 1962), lizards (Dixon, 1956) and frogs (Shannon, 1956). Won (1971) presents the following data on its breeding, based on observations of 8 females: eggs are laid in June or July; number of eggs laid is 6-8, their size is 2.8×4.7 mm (obvious error!); incubation takes 30-42 days. A female examined by Webb et al. (1962) contained 6 egge. Dixon (1956) reports (and we can confirm this fact) that all captured specimens were docile and made no attempt to bite.

Elaphe rufodorsata (Cantor, 1842)

Tropidonotus rufodorsatus Cantor, 1842, Ann. Mag. Nat. Hist., 9:483 (type locality: Chusan Island, China). *Elaphe rufodorsata*.-Stejneger, 1907, Herp. Japan, p. 310.-Slevin, 1925, Proc. Calif. Acad. Sci., (4), 14:96.-Maki, 1931, Monogr. snakes Japan, p. 86.-Steward, 1954, Copeia, p. 66.-Babb, 1955, Philad. Herp. Soc. Bull., 1:21.-Shannon, 1956, Herpetologica, 12:45. -Dixon, 1956, Herpetologica, 12:54.-Won, 1956, List animal names, p. 254.-Hahn, 1960, J. Ohio Herp. Soc., 2:20.-Webb et al., 1962, Univ. Kansas Publ. Mus. Nat. Hist., 15:167.-Won, 1971, Amph. rept. fauna Korea, p. 146.-Kang and Yoon, 1975, Encycl. fauna flora Korea, 17:157.-Szyndlar, 1984, Acta Zool. Cracov., 27:11. *Enhydris rufodorsata*.-Paik, 1982, Syst. stud. Serp. Korea, p. 62.

Range.-North Korea, South Korea excluding Cheju Island (Paik, 1982), the Soviet Far East (Bannikov et al., 1977), eastern China including Taiwan (An Illustrated Monograph of the Snakes of China, 1980).

Distribution in DPRK (Fig. 3).-I. Pyongyang City: 1. Pyongyang (Won, 1971: 150).-II. South Pyongan Province: 7. Kaechon (ZIP 88, 89, 91-94, 96), 13. Taesongho (Szyndlar, 1984:11; ZIP 100, 115).-III. North Pyongan Province : 21. Sonchon (ZIP 87, 90).-VI. North Hamgyong Province: 41. Puryong (Slevin, 1925:97; Shannon, 1956:45), 43. Sahoe-ri (ZIP 97).-VIII. Kangwon Province: 51. Cholwon (Shannon, 1956:45), 61. Wonsan (Slevin, 1925:96; Shannon, 1956:45).

Description.-Material examined: 6 males (ZIP 87, 89, 90, 97, 98, 115), 11 females (ZIP 88, 91-96, 100, 117, ZZSiD 803 and 804), and one juvenile of undetermined sex (ZIP 126). In males, ventrals 160-174 (mean 168.3±4.9), subcaudals 57-61 (mean 58.3±1.6). In females, ventrals 168-183 (mean 177.0±4.0), subcaudals 48-57 (mean 52.7±4.1). Anal divided. Scales smooth. Scale rows 23-21-19. Largest

male 425+107 mm (ZIP 89), largest female 592+114 mm (ZIP 95). Preoculars 1, postoculars 2, temporals 2+3, upper labials 7 or 8, upper labials entering eye 3 and 4 or 4 and 5, lower labials 9. Dorsum brown or red brown, with four rows of black-edged dark spots; on the posterior half of the body, including the tail, these spots form continuous longitudinal stripes. On the venter, red (or orange-brown) and black squares form a chequered pattern.

A huge sample of specimens of *Elaphe rufodorsata*, examined by most students of the Korean herpetofauna (Stejneger, 1907; Slevin, 1925; Maki, 1931; Steward, 1954; Shannon, 1956; Dixon, 1956; Webb et al., 1962; Won, 1971; Paik, 1982; Szyndlar, 1984), displays considerable variation in the number of ventrals and subcaudals-for males 154-181 and 40-67, for females 155-187 and 46-62, respectively. Scale rows 21 at midbody, except for two males reported by Steward (1954) that have 19 rows each. Preoculars always 1; postoculars always 2; temporals 2+3, sometimes 2+2, rarely 1+2 or 1+3; upper labials 7 or 8; lower labials 10 or 9. Largest individuals of *E. rufodorsata* from Korea are a male 576+162 mm and a female 817+174 mm (Maki, 1931).

Habitat and habits.-*Elaphe rufodorsata* is one of the most common snakes in North Korea. All students of the Korean herpetofauna emphasize the semi-aquatic behaviour of this species. It is most common in or near streams, lakes, rice fields and dikes between rice fields (Steward, 1954; Shannon, 1956; Dixon, 1956; Hahn, 1960; Webb et al., 1962; Won, 1971; Szyndlar, 1984), but it also has been found on barren hillsides and roads and along drainage ditches (Webb et al., 1962). This snake constricts its prey. It usually feeds on frogs (Dixon, 1956; Shannon, 1956; Won, 1971; Szyndlar, 1984), but also takes lizards (Dixon, 1956), toads (Steward, 1954), fish (Shannon, 1956) and beetles (Won, 1971). A case of cannibalism was also noticed (Szyndlar, personal observation, 1980). *Elaphe rufodorsata* hibernates under roots and rocks and in burrows of rats (Won, 1971). Copulations were observed at the end of April and beginning of May (Webb et al., 1962). According to Won (1971), these ovoviviparous snakes start to lay eggs in mid-August, usually in crumpled grass; young snakes hatch after one or two minutes (this information may be erroneous!); length of young snakes is snout-vent 170-200 mm, tail 30-45 mm; females copulate immediately after laying of eggs. Three females caught in June 1980 gave birth to 7 babies each from 2 September through 7 October (Sura, 1981; Szyndlar, 1984). Nearly all individuals attempt to bite when captured (Dixon, 1956; Hahn, 1960; Szyndlar, personal observation).

Remarks.-By its ovoviviparity and semi-aquatic habitat *Elaphe rufodorsata* distinctly differs from other species of the genus *Elaphe*, which are terrestrial and oviparous. Biochemical studies of this genus, undertaken by Lawson and Dessauer (1981), confirm the distinctiveness of *E. rufodorsata*. According to these authors, genetic distances (D) distinguishing *E. rufodorsata* from other members of the genus

Elaphe (sensu lato) exceed the value 0.7. Paik (1982), after having compared *E. rufodorsata* with several homalopsine snakes, placed *rufodorsata* in the genus *Enhydris*. Paik (1982:86) based his startling conclusion on the following features observed in both *rufodorsata* and members of the genus *Enhydris*:"…ovoviviparity, aquatic habitation, and the number and shape of scales." Unfortunately, he made no attempt to compare the internal morphology of these snakes. In fact, regarding osteology, *Elaphe rufodorsata* does not differ significantly from several European and Asiatic species of *Elaphe* (Szyndlar, unpublished (*)), while it completely differs from homalopsine snakes (see Gyi, 1970, for details). While *rufodorsata* should, perhaps, be removed from the genus *Elaphe*, undoubtedly it cannot be included in the genus *Enhydris*.

Elaphe schrenckii schrenckii Strauch, 1873

Elaphis schrenckii Strauch, 1873, Mém. Acad. Imp. Sci. St.-Pétersbourg, (7), 21:100 and 272 (type locality: Khinggan, Siberia).

Elaphe schrenckii schrenckii.-Pope, 1935, Rept. China, p. 270. *Elaphe schrencki schrencki*.-Shannon, 1956, Herpetologica, 12:46.

Range.-Probably northern and eastern parts of North Korea, Chinese Manchuria (Pope, 1935, and references therein), the Soviet Far East (Bannikov et al., 1977).

Distribution in DPRK (Fig. 3).-VIII. Kangwon Province: 61. Wonsan (Slevin, 1925:97; Shannon, 1956: 46).

Remarks.- According to Shannon (1956), the Korean Peninsula is inhabited by two subspecies of *Elaphe schrenckii*; the range of *anomala* is supposed to be restricted to the western coast of North Korea and the whole of South Korea, while that of *schrenckii* covers the northern and eastern parts of North Korea. The only typical representative of the subspecies *schrenckii*, recognized by Shannon, 1956 (previously described by Slevin, 1925), comes from Wonsan of the Japanese Sea coast. Unfortunately, *Elaphe schrenckii* has never been recorded from the northeastern provinces of North Korea; the specimen ZIP 20, coming from the northeasternmost point (Myohyang-san), no doubt represents a typical *anomala* (vide infra). However, two adult individuals kept in the Pyongyang Zoo (observation in 1984) and with certainty caught in North Korea are typical *schrenckii*. They are pitch black, with distinct narrow light bands extending from the neck throughout the length; in the anterior portion of the body the bands are white, while in the posterior portion they are yellow. Unfortunately, the exact point of origin of these specimens (or even the province) remains unknown.

Elaphe schrenckii anomala (Boulenger, 1916)

Coluber anomalus Boulenger, 1916, Ann. Mag. Nat. Hist., (8), 17:243 (type lo-

(*) Examined skeletons of *Elaphe rufodorsata*:ZZSiD 270 and 367 (adults, Taesong-ho, North Korea) and ZZSiD 299-302 (juveniles, USSR).

cality: Chihfeng, China).

Elaphe schrenckii. -Stejneger, 1907, Herp. Japan, p. 313. -Slevin, 1925, Proc. Calif. Acad. Sci., (4), 14:97.-Maki, 1931, Monogr. snakes Japan, p. 101.-Won, 1956, List animal names, p. 254.-Won, 1971, Amph. rept. fauna Korea, p. 143. -Kang and Yoon, 1975, Encycl. fauna flora Korea, 17:162.-Paik, 1982, Syst. stud. Serp. Korea, p. 54.

Elaphe schrenckii. -Babb, 1955, Philad. Herp. Soc. Bull., 1:21. *Elaphe schrenckii anomala*.-Pope, 1935, Rept. China, p. 266. *Elaphe schrenckii anomala*.-Shannon, 1956, Herpetologica, 12:45.-Dixon, 1956, Herpetologica, 12:55.-Hahn, 1960, J. Ohio Herp. Soc., 2:21.-Webb et al., 1962, Univ. Kansas Publ. Mus. Nat. Hist., 15: 168.

Range. - Western part of North Korea, South Korea excluding Cheju Island (Paik, 1982), north-eastern China excluding Manchuria (Pope, 1935, and references therein; An Illustrated Monograph of the Snakes of China, 1980).

Distribution in DPRK (Fig. 3).-II. South Pyongan Province: 8. Myohyangsan (ZIP 20). - III. North Pyongan Province: 24. Unmu-do (ZIP 29). - VIII. Kangwon Province: 51. Cholwon (Shannon, 1956:45). -IX. North Hwanghae Province: 66. Kurig-ri (ZIP 83).-XI. Kaesong City: 81. Kaesong (ZIP 21, 84-86).

Description. -Material examined: two males (ZIP 20 and 83),two females (ZIP 21 and 29), and three juveniles of undetermined sex (ZIP 84, 85, and 86). In males, ventrals 226 and 216, subcaudals 70 and 74, snout-vent ant tail lengths 1, 110 +200 and 820+170 mm, respectively. In females, ventrals 222 and 236, subcaudals 72 and 58, snout-vent and tail lengths 1, 330+260 and 1, 070+180 mm, respectively. Except for one individual, anal divided. Dorsal scales keeled, especially those on the upper part of the anterior half of the body. Scale rows 23-23-19, in one case 21-21-19. Preocular 1, postoculars 2, temporals 2+3, upper labials 8, upper labials entering eye 4 and 5, lower labials 9 or 10. Dorsum with dark bands posteriorly (including tail). Anteriorly, the bands are either indistinct or replaced by small irregular markings; in one case (ZIP 20), the latter are also present on the head. The maximum number of bands in adults 38. On the posteriormost portion of the body and on the tail, the dark bands are separated by broad light interspaces. In juveniles (ZIP 84 and 85), the dorsum is dark, with about 50 narrow, black-edged light bands extending from the neck throughout the length.

Features of other specimens known from Korea (Stejneger, 1907; Slevin, 1925; Maki, 1931; Shannon, 1956; Dixon, 1956; Webb et al., 1962) are as follows: ventrals and subcaudals 211-227 and 62-76 in males, 212-223 and 57-75 in females (lowest number of subcaudals, noted in an individual of unknown sex, is 56-Won, 1971); scale rows always 23 at midbody; anal divided, very rarely single; preoculars 1, very rarely 2; postoculars 2, very rarely 1; temporals 2+3, exceptionally 1+3 or 2+4; upper labials usually 8; lower labials usually 10, sometimes 9 or 11;

total number of dark bands on the whole body 36-41, in one case (Maki, 1931), 82 (apparently an erroneous value). The number of ventrals, 128 and 129, given by Slevin (1925) for two females, are obviously erroneous. It is to be noted that one of our females (ZIP 29) has an exceptionally high number (236) of ventrals. The largest specimens of *Elaphe schrenckii* reported from Korea are a male 1,494+254 and a female 1,434+213 mm (Maki, 1931).

Habitat and habits. - According to Won (1971), *Elaphe schrenckii* occurs usually in cultivated areas, among stones and in villager's houses. Specimens described by Webb et al. (1962) were observed on dry, scrubby or forested hillsides and in grassy upland areas. Dixon (1956), who found his only individual in aquatic vegetation, supposed that this species is semi-aquatic. It feeds on rats, sparrows, and occasionally hen's eggs (Won, 1971), also on mice and bats (Webb et al., 1962). Disappearance for hibernation occurs at the end of October; the snake hibernates among decaying roots and in homesteads, and reemerges in April (Won,1971). Eggs are laid during the period from June to July; they number 8-21 and measure 24-38 mm; and incubation takes 58-60 days (Won, 1971). A female examined by Webb et al. (1962) contained 17 eggs, each ca. 32 mm long. In South Korea, live snakes are sold in shops and streets (Babb, 1955). Hahn (1960) reported that Koreans believe this snake to be a powerful spirit of the household and treat it with great respect. In Korea, for a very long time up to the present, this snake has served for production of strengthening medicines (Won, 1971). Indeed, in modern North Korea, *Elaphe schrenckii* is employed as the only non-viperid species in the preparation of a therapeutic brandy.

Elaphe taeniura taeniura Cope, 1861

Elaphe taeniurus Cope, 1861, Proc. Acad. Nat. Sci. Philad., 12:565 (type locality: Ningpo, China). -Stejneger, 1907, Herp. Japan, p. 319. - Shannon, 1956, Herpetologica, 12:46. *Elaphe taeniura*.- Won, 1971, Amph. rept. fauna Korea, p. 146. *Elaphe taeniura taeniura*. - Maki, 1931, Monogr. snakes Japan, p. 96. - Babb, 1955, Philad. Herp. Soc. Bull., 1:21.- Kang and Yoon, 1975, Encycl. fauna flora Korea, 17:159.-Paik, 1982, Syst. stud. Serp. Korea, p. 55.

Coluber taeniura friesei Werner, 1926, Sitz. Ber. Akad. Wiss. Wien, Abt. I,135: 245 (type locality: Taiwan).

Elaphe taeniura friesei.- Maki, 1931, Monogr. snakes Japan, p. 94.

Elaphe taeniura (sic) *friesei*.- Won, 1956, List animal names, p. 254.

Range.- Western and southern China including Taiwan (An Illustrated Monograph of the Snakes of China, 1980), eastern India (Murthy, 1985), Burma (Smith, 1943), northern and western Indochina (Taylor,1965), Malay Peninsula, Sumatra and Borneo (? subspecies *ridleyi* and *grabowskyi*) (de Rooij; 1917; Grandison, 1978).

Distribution in DPRK.- Recorded only once from an undefined Korean locali-

ty (Stejneger, 1907:320).

Remarks. - This species is traditionally placed on Korean herpetological lists, albeit since Stejneger's report (1907) none of the later students has confirmed its presence in the Korean Peninsula. Kim and O (1982), in their popular book on the Korean animals, supposed that *Elaphe taeniura* is present everywhere in Korea, but is rarely seen because of its secretive habit. This opinion, however, based on neither new records nor field observations, cannot be accepted. The senior author of the present paper, during examination of the ZIP collection in 1984, located a specimen labelled as *Elaphe taeniura* (locality Ryokpo in the Pyongyang City province), but this snake is actually an *Elaphe davidi* (see Szyndlar, 1985). Two old records from the vicinities of the North Korean frontier, one from the Possiet Bay area (Strauch, 1873) and the other from the valley of the Yalu River (=Amnokgang)(Sowerby, 1930), have not been confirmed later by new materials. In Pope's (1935) opinion, *Elaphe taeniura* may have been introduced into northern China by man. Presence of this snake in Korea remains an open question.

Amphiesma vibakari ruthveni (Van Denburgh, 1923)

Tropidonotus vibakari Boie, 1826, Isis, p. 207 (type locality: Japan).
Natrix vibakari. -Stejneger, 1907, Herp. Japan, p.266. -Mori, 1928, J. Chosen Nat. Hist. Soc., 6: 49.
Natrix vibakari vibakari. -Slevin, 1925, Proc. Calif. Acad. Sci., (4), 14: 95.
Natrix vibakari ruthveni Van Denburgh, 1923, Proc. Calif. Acad. Sci., (4), 13: 3 (type locality: Pusan, South Korea). -Maki, 1931, Monogr. snakes Japan, p. 34. -Babb, 1955, Philad. Herp. Soc. Bull., 1: 20. -Shannon, 1956, Herpetologica, 12: 43. -Won, 1971, Amph. rept. fauna Korea, p. 136. -Kang and Yoon, 1975, Encycl. fauna flora Korea, 17: 149. - Paik, 1982, Syst. stud. Serp. Korea, p. 46. *Amphiesma vibakari ruthveni*.- Malnate, 1962, Proc. Acad. Nat. Sci. Philad., 114: 258. -Webb et al., 1962, Univ. Kansas Publ. Mus. Nat. Hist., 15: 165.

Range. - North Korea, South Korea including Cheju Island (Paik, 1982), north-eastern provinces in China (An Illustrated Monograph of the Snakes of China, 1980), the Soviet Far East including Sakhalin (Bannikov et al., 1977), Japan (subspecies *vibakari*) (Sengoku, 1979).

Distribution in DPRK (Fig. 3).-I. Pyongyang City: 1. Pyongyang (Won,1971 :138), 5. Wonsin-ri (Won, 1971:138). -III. North Pyongan Province: 19. Sinuiju (Shannon, 1956: 43; Malnate, 1962: 254).- IV. Chagang Province: 25. Yangchori (ZIP 26, 27), 26. Yangdok-ri (Won, 1971: 138), unknown locality (ZIP 3). - VI. North Hamgyong Province: 43. Sahoe-ri (Malnate, 1962: 254). -X. South Hwanghae Province: 78. Sunwi-do (Won, 1971: 138).

Description. - One male (ZIP 3), ventrals 146, subcaudals 54, snout-vent length 290 mm, tail length 80 mm. Two females (ZIP 26 and 27), ventrals 142 each, subcaudals 58 and 30 (tail incomplete), snout-vent length 350 and 360 mm, tail

length 100 and 60+ mm. Anal divided. Scales weakly keeled in 19-19-17 rows, in one case (ZIP 26) 18-17-17. Preocular 1, postoculars 3 or 2, temporals 1+1, upper labials 7, upper labials entering eye 3 and 4, lower labials 8. Dorsum is uniformly gray brown.

Other specimens reported from Korea have the following numbers of ventrals and subcaudals: males 145-154 and 54-68 (Slevin, 1925; Maki, 1931; Webb et al., 1962; Won, 1971), females 142-153 and 56-65 (Stejneger, 1907; Slevin, 1925; Maki, 1931). According to Malnate (1962), the number of subcaudals of the subspecies *ruthveni* varies from 54 to 69. The number of subcaudals, 29 and 49, observed by Won (1971) in two females, is therefore surprisingly low (most likely their tails are incomplete). Remaining features of the Korean *Amphiesma vibakari* described by the previous authors are as follows: dorsal scales always 19 at midbody; preoculars 1, exceptionally 2; postoculars 2 or 3, in one case 1 (Maki, 1931); temporals 1+1, in one case 1+2 (Maki, 1931); upper labials 7, exceptionally 6; lower labials 8. The largest *Amphiesma vibakari* reported from Korea is a female with a snout-vent length of 385 mm (Won, 1971; unfortunately, the value of 415 mm given for the tail length of this specimen is undoubtedly erroneous). Specimens of similar size, both males, were also reported from Korea by Maki, 1931 (snout-vent length 380 mm, tail length not given), and by Webb et al., 1962 (380+128 mm).

Habitat and habits.-*Amphiesma vibakari* inhabits bushy and stony areas in low valleys (Won, 1971). Specimens reported by Webb et al. (1962) were collected in grassy areas, earthen banks of road cuts, and near a stream. Stomach of examined individuals contained earthworms (Webb et al., 1962) and crickets (Won, 1971). Won (1971) also reported a case where a snake 550 mm long swallowed a frog 220 mm long. Eggs are laid in July. A female examined by Won (1971) contained 5 eggs, 19-22×7-8 mm.

Rhabdophis tigrinus (Boie, 1826)

Tropidonotus tigrinus Boie, 1826, Isis, p. 205 (type locality: Japan). -Giglioni and Salvadori, 1887, Proc. Zool. Soc., p. 594. *Natrix tigrina*.-Stejneger, 1907, Herp. Japan, p. 272. - Mori, 1928, J. Chosen Nat. Hist. Soc., 6:49.

Natrix tigrina tigrina. - Slevin, 1925, Proc. Calif. Acad. Sci., (4), 14: 95.

Tropidonotus lateralis Berthold, 1859, Nachricht. Ges. Wiss. Goettingen, p. 180 (type locality: China).

Natrix tigrina lateralis. - Stejneger, 1907, Herp. Japan, p. 278. Maki, 1931, Monogr. snakes Japan, p. 45. -Tanner, 1953, Great Basin Nat., 13: 72. -Steward, 1954, Copeia, p. 66. - Babb, 1955, Philad. Herp. Soc. Bull., 1: 21. - Shannon, 1956, Herpetologica, 12: 42.- Dixon, 1956, Herpetologica, 12: 54.-Hahn, 1960, J. Ohio Herp. Soc., 2: 20. - Won, 1971, Amph. rept. fauna Korea, p. 135. -

Kang and Yoon, 1975, Encycl. fauna flora Korea, 17: 151.
Rhabdophis tigrina. - Malnate, 1960, Proc. Acad. Nat. Sci. Philad., 112:49.
Rhabdophis tigrina lateralis. -Webb et al., 1962, Univ. Kansas Publ. Mus. Nat., Hist., 15:164.
Rhabdophis tigrinus lateralis. -Szyndlar, 1984, Acta Zool. Cracov., 27:11.
Rhabdophis tigrina tigrina. - Paik, 1982, Syst. stud. Serp. Korea, p. 48.

Range. - North Korea, South Korea including Cheju Island (Paik, 1982), eastern half of China except southernmost provinces (An Illustrated Monograph of the Snakes of China, 1980), the Soviet Far East (Bannikov et al., 1977), Japan (? subspecies *tigrinus*) (Nakamura and Uéno, 1969).

Distribution in DPRK (Fig. 3). - II. South Pyongan Province: 8. Myohyang-san (Szyndlar, 1984:11), 13. Taesong-ho (Szyndlar, 1984:11, addendum; ZZSiD 889-892). - III. North Pyongan Province : 20. Sogha-ri (Won, 1971 : 135), 21. Sonchon (ZIP 102-104), 23. Uiju (Slevin, 1925:96; Shannon, 1956:43). - VIII. Kangwon Province: 51. Cholwon (Shannon, 1956:42), 55. Kumgang-san (ZIP 105), 59. Samil-po (Szyndlar, 1984:11), 61. Wonsan (Giglioni and Salvadori, 1887:594; Slevin, 1925:96; Shannon, 1956:43).-IX. North Hwanghae Province: 65. Kumchon ZIP 123), 67. Paegyang (Won, 1971:135).

Description. - Material examined: 9 males (ZIP 103, 109, 110, 112, 113, (ZZSiD 805, 890-892), 9 females (ZIP 101, 102, 105, 108, 111, 116, ZZSiD 807, 812, 889), and 3 juveniles of undetermined sex (ZIP 104, 123, 127). In males, 151 -177 ventrals (mean 165.7±7.1), 56-73 subcaudals (mean 63.8±5.5). In females, 153-167 (mean 162.1±5.0) ventrals, 49-62 (mean 57.3±7.5) subcaudals. Anal divided. Scales keeled. Scale rows 21-19-17; in two cases 17 scales at midbody. Largest male 757+169 mm (ZZSiD 805), largest female 769+148 mm (ZIP 101). Preoculars 2; postoculars 3; temporals 1+2 or 1+3; upper labials usually 7, in two cases 6; upper labials entering eye 3 and 4; lower labials 8, in one case 7. Dorsum olive green, with series of large black spots, diminishing posteriorly; in the anteriormost part of the body the spots are separated by red interspaces. Venter black.

Description of a large number of *Rhabdophis tigrinus* from Korea (Slevin,1925; Maki, 1931; Tanner, 1953; Steward, 1954; Shannon, 1956; Dixon, 1956; Won, 1971; Paik, 1982; Szyndlar, 1984) can be summarized as follows: ventrals and subcaudals 153-174 and 57-74 in males (Won, 1971, reported as few as 46 subcaudals for one male; for another male, from Cheju Island, Paik, 1982, reported 79 subcaudals), ventrals and subcaudals in females 156-177 and 55-72, respectively; scale rows always 19 at midbody; preoculars always 2; postoculars 3, rarely 4 or 2; temporals always 1+2; upper labials 7; lower labials 8 or 9, rarely 10 or 7. Largest specimens reported from Korea are a male 817+174mm (Maki, 1931) and a female 790+167mm (Won, 1971). For further comments see Remarks.

Habitat and habits. - *Rhabdophis tigrinus* is one of the commonest North Korean snakes. This species was usually taken in grass bordering streams, small rivers, ponds, lakes and rice fields (Steward, 1954; Babb, 1955; Shannon, 1956; Hahn, 1960; Webb et al., 1962; Won, 1971; Szyndlar, 1984). It was also observed on small grassy hills (Tanner, 1953), brushy hillsides and along drainage or irrigation ditches (Webb et al., 1962). Although this snake is commonest in close association with water, it was never observed in water (Shannon, 1956), unless it attempted to escape by swimming (Hahn, 1960). Usually this snake escapes away from a stream into the bordering bushes (Steward, 1954). It was only occasionally found in swampy ground or rice fields (Shannon, 1956) and never on dikes between them (Szyndlar, 1984). Frogs form a large part of the diet; they are usually seized by the hind limbs and swallowed rear end first (Szyndlar, personal observations; Shannon, 1956). *Rhabdophis tigrinus* also feeds on fish, mice, birds (Won, 1971), tadpoles and beetles (Hahn, 1960). The snake emerges from hibernation at the end of April (Hahn, 1960; Won, 1971) and disappears at the beginning of November (Won, 1971). According to Won (1971), females lay 8-32 eggs (egg dimensions given by Won-2.8×3.2mm-are evidently erroneous) and the incubation period lasts from 35 to 40 days. Webb et al. (1962) reported that eggs number 9-10, 15-18 mm in size. A female captured in June, 1980, laid 27 eggs; 3 young snakes hatched after 35 days (Sura, 1981; Szyndlar, 1984). Annoyed specimens flatten the entire length of their bodies dorsoventrally and lift the anterior portion of the trunk above the ground (Hahn, 1960; Szyndlar, personal observation). Another startling behaviour, reported by Hahn (1960), was the bending of the head downwards at the neck about twenty degrees and holding this position rigidly for several minutes. Bites of this opisthomegadontic (but not opisthoglyphous!) snake may produce severe envenomation in man (Mittleman and Goris, 1974; Kono and Sawai, 1975); also one fatal case was reported from Japan (Mittleman and Goris, 1978). North Koreans also are familiar with the potential danger from this snake's bite (Won, 1971).

Remarks. - Stejneger (1907:278) first observed that the Japanese and continental populations of *Rhabdophis tigrinus* can be easily differentiated from each other on the basis of subcaudal counts. For the former group (subspecies *tigrinus*), Stejneger noted 66-85 subcaudals and for the latter group (subspecies *lateralis*) 53-64 subcaudals. Stejneger's observations were generally confirmed by several subsequent authors, although in the meantime, with the accumulation of specimens collected in Korea, it became evident that subcaudal numbers in both populations overlapped. Maki (1931:46) also noted a gradual increase in the number of subcaudals from north to south, while Shannon (1956:42) denied this opinion. Other authors (cf. Nakamura and Ueno, 1969:168, and references therein), contending that there is not a clear geographical boundary between the subspecies, suggested that *lateralis* should be synonymized with *tigrinus*. Recently Paik (1982:49) demonstrated that the

number of subcaudals in *Rhabdophis tigrinus* from peninsular South Korea is significantly lower than that from Cheju Island; "··· because of the continuity in the number of subcaudals as well as the small genetic variation···", Paik regarded *lateralis* as a synonym of *tigrinus*. In our opinion, since post-Stejneger studies clearly revealed a wide overlapping of subcaudal counts in the Japanese and Korean populations, there is no reason to recognize the subspecies *lateralis* any longer. Moreover, because of the doubtful taxonomic status of the two other subspecies of this form, i. e., *formosiana* and *multiventris*, we regard *Rhabdophis tigrinus* to be a monotypic species.

(?)*Sibynophis chinensis* (Guenther, 1889)

Ablabes chinensis Guenther, 1889, Ann. Mag. Nat. Hist, .(6),4:220 (type locality: Ichang, China).

Sibynophis chinensis.- Pope, 1935, Rept. China, p.82.

Sibynophis collaris. -Maki, 1931, Monogr. snakes Japan, p.23 (part). -Paik, 1982, Syst. stud. Serp. Korea, p.51.

Range.- Eastern China including Taiwan (An Illustrated Monograph of the Snakes of China, 1980).

Distribution in DPRK.- Never recorded.

Remarks.- A member of this genus, unknown from North Korea, was recently reported by Paik (1982) from Cheju Island, a part of the territory of South Korea. Paik identified his find as *Sibynophis collaris* (Gray, 1853), however, the presence of this Oriental species in Korea seems to be highly improbable, thus Paik's snake may belong instead to the closely related *S. chinensis*. Based on Paik's description, exact specific allocation of the Cheju specimen cannot be fully demonstrated. Presumably, Paik used the name *collaris* following the work of Maki (1931), who included both the taxa within a single species, although since Pope (1929) *chinensis* and *collaris* are consistently regarded to be clearly distinct species. Presentation by Paik (1982:Table 27) of the combined ranges of both *S. chinensis* and *S. collaris*, attributed to the latter species only, support the above supposition.

Family Hydrophiidae

Hydrophis cyanocinctus Daudin, 1803

Hydrophis cyanocinctus Daudin, 1803, Hist. Nat. Rept., 7:383 (type locality: Hainan Strait).- Won, 1971, Amph. rept. fauna Korea, p. 154.

Disteira cyanocincta. - Stanley, 1914, J. N.- China Brit. Roy. Asiat. Soc., (n. ser.), 45:30.- Babb, 1955, Philad. Herp. Soc. Bull., 1:22.

Range. - Coasts of southern and eastern Asia from the Persian Gulf eastward to the Great Sunda Islands and northward to the Yellow Sea (Minton, 1975). Except for one uncertain record (Babb, 1955), never reported from South Korea.

Distribution in DPRK. - VII. South Hamgyong Province: 48. Kachin (Japanese

Sea) (ZIP 2).

Description. - A single male (ZIP 2). Ventrals 368, subcaudals 63. Anal quadruple. Scale rows 32-38-35, Snout-vent length 1, 550 mm, tail length 130 mm. Preocular 1, Postoculars 2, temporals 2(?3)+2, upper labials 7, upper labials 3, 4, and 5 entering eye, lower labials 7. Dorsum (in formalin) yellow, with above 70 dark crossbands; the dark bands are less distinct posteriorly than anteriorly.

Hydrophis melanocephalus Gray, 1849

Hydrophis sublaevis var. *melanocephala* Gray, 1849, Cat. snakes Brit. Mus., p. 53 (type locality: "Indian Ocean").

Disteira spiralis melanocephala. - Stejneger, 1913, Denkschr. Akad. Wiss. Wien, 40:346.- Won, 1956, List animal names, p.252. *Hydrophis melanocephalus*.-Smith, 1926, Monogr. sea snakes, p. 64. - Shannon, 1956, Herpetologica, 12:47.- Won, 1971, Amph. rept. fauna Korea, p. 152.- Kang and Yoon, 1975, Encycl. fauna flora Korea, 17:165.

Hydrophis melanocephala.- Paik, 1982, Syst. stud. Serp. Korea, p. 75.

Range.- The South China Sea, the Ryukyu Archipelago, the Yellow Sea (Minton, 1975). Recorded from South Korea.

Distribution in DPRK.- X. South Hwanghae Province: 73. Ongjin (Yellow Sea) (Won, 1971:154; ZIP 1).

Description. -A single specimen (ZIP 1), probably female. Ventrals 341, subcaudals 42. Anal quadruple. Scale rows 32-40-37. Snout-vent length 890 mm, tail length 100 mm. Preocular 1, postoculars 2, temporals 1 + (?)2, upper labials 8, upper labials 4 and 5 entering eye, lower labials 7. Dorsum (in formalin) yellow, with 66 dark crossbands.

Pelamis platurus (Linnaeus, 1766)

Anguis platura Linnaeus, 1766, Syst. Nat., ed. 12, p. 391 (type locality:unknown).

Hydrus platurus.- Stejneger, 1907, Herp. Japan, p. 439.

Pelamydrus platurus. -Maki, 1931, Monogr. snakes Japan, p. 192. -Babb, 1955, Philad. Herp. Soc. Bull., 1:22.- Won, 1956, List animal names, p.252.

Pelamis platurus.-Smith, 1926, Monogr. sea snakes, p. 116.-Shannon, 1956, Herpetologica, 12:47.-Won, 1971, Amph. rept. fauna Korea, p. 156.-Kang and Yoon, 1975, Encycl. fauna flora Korea, 17:167.-Paik, 1982, Syst. stud. Serp. Korea, p.76.

Range. - Indian Ocean and Pacific Ocean from the Persian Gulf to the western coasts of Mexico and Central America, northward to the Yellow Sea (Minton, 1975).

Distribution in DPRK. - Never recorded.

Remarks. - This species is known from both south Korea (Shannon, 1956; Paik, 1982) and the Possiet Bay near the Russian-Korean frontier (Strauch, 1873: a single specimen). Its presence in the seas washing the North Korean coasts is therefore highly probable.

Family Viperidae

Vipera berus berus (Linnaeus,1758)

Coluber berus Linnaeus, 1758, Syst. Nat., ed. 10,1:217 (type locality: Upsala, Sweden).-Mori, 1930, J. Chosen Nat. Hist. Soc., 10:57.

Vipera berus.-Daudin, 1803, Hist. nat. rept., 6:89.

Vipera berus sachalinensis Carevskij, 1917, Ezh. Zool. Muz. Akad. Nauk, 21:37 (type locality: Sakhalin).-Maki, 1931, Monogr. snakes Japan, p.195.-Babb,1955, Philad. Herp. Soc. Bull., 1:22.-Shannon, 1956, Herpetologica, 12:48. -Won, 1956, List animal names, p.254. -Won, 1971, Amph. rept. fauna Korea, p. 162. -Kang and Yoon, 1975, Encycl. fauna flora Korea, 17:170. -Paik, 1982,Syst. stud. Serp. Korea, p. 65.

Range.-Northernmost parts of the Korean Peninsula, Kirin and Szechwan provinces in northern China (An Illustrated Monograph of the Snakes of China, 1980), north-central Mongolia (Bannikov, 1958), southern East Siberia including Sakhalin (subspecies *sachalinensis*), central West Siberia and northern half of European Russia (Bannikov et al., 1977), Europe excluding Mediterranean peninsulas.

Distribution in DPRK (Fig. 4).-III. North Pyongan Province: 19. Sinuiju (Shannon, 1956:48).-V. Ryanggang Province: 27. Kanpaeg-san (ZIP 13), 28. Paegam (Won, 1971:164), 29. Paekdu-san (Won, 1971:164), 31. Rimyongsu (Won, 1971:164; ZIP 9-12), 32. Sobaek-san (Won, 1971:164).-VI. North Hamgyong Province: 38. Kwanmo-bong (Won, 1971:164; ZIP 7, 8). -VII. South Hamgyong Province:46. Chail-bong (Won,1971:164; ZIP 58).

Description. -Material examined: 4 males (ZIP 7, 8, 9, and 10), 2 females (ZIP 11 and 13), and 2 individuals of undetermined sex (ZIP 12 and 58). These specimens will be described in detail elsewhere (Nilson, Andrén and Szyndlar, in preparation).

Habitat and habits.-Won (1971) presented the following observations on *Vipera berus* from Korea: it inhabits wet bushy areas or the vicinity of running water in high mountains; the species feeds on frogs, birds and bird's eggs; in 1968, young specimens, 100 mm long, were once observed as early as 1 August. No further data are available from Korea.

Remarks.-According to current knowledge of its distribution, the Manchurian -Korean populations of *Vipera berus* are most likely isolated from those inhabiting Siberia and Mongolia. Maki (1931) first designated the Manchurian-Korean *Vipera berus* as belonging to the subspecies *sachalinensis*, and Maki's interpretation was accepted by later students of the Korean herpetofauna (Shannon,1956; Won,1971; Kang and Yoon, 1975; Paik, 1982). However, in the ZIP specimens we examined the head scutellation is characteristic of the nominate subspecies of *V. berus* and not *sachalinensis*; the frontal scales do not adjoin the supraoculars and there is

always more than one scale between the nasal and the eye (cf. Carevskij, 1917; Saint Girons, 1978). The Korean adder is therefore provisionally classified as *Vipera berus berus*. It should be noted that specimens from the Chinese province of Kirin, which borders upon North Korea, were also identified as *V. b. berus* (Zhao et al.,1981). The taxonomic status of the Korean *V. berus* will be further discussed in another paper (Nilson, Andrén and Szyndlar, in preparation).

Agkistrodon blomhoffii brevicaudus Stejneger, 1907

Trigonocephalus blomhoffii Boie, 1826, Isis, p.214 (type locality: Japan).-Giglioni and Salvadori, 1887, Proc. Zool. Soc., p. 594. *Agkistrodon blomhoffii brevicaudus* Stejneger, 1907, Herp. Japan, p. 463 (type locality: Fusan, South Korea).-Slevin, 1925, Proc. Calif. Acad. Sci.,(4),14:99 (part).-Mori, 1928,J. Chosen Nat. Hist. Soc.,6:50.-Tanner, 1953, Great Basin Nat.,13:73.- Gloyd, 1972, Proc. Biol. Soc. Wash., 85:560.-Paik et al., 1979, Korean J. Zool., 22:passim.-Paik, 1982, Syst. stud. Serp. Korea, p. 68.-Szyndlar, 1984, Acta Zool. Cracov., 27:12.

Agkistrodon halys brevicaudus. -Maki, 1931, Monogr. snakes Japan, p. 206 (part). -(?) Babb, 1955, Philad. Herp. Soc. Bull., 1:22. -Won, 1956, List animal names, p.254.- Hahn, 1960, J. Ohio Herp. Soc., 2:21.-Webb et al., 1962, Univ. Kansas Publ. Mus. Nat. Hist., 15:170 (part).

Ancistrodon halys brevicaudus.-Shannon, 1956, Herpetologica, 12:47 (part).

Ancistrodon halys.-Won, 1971,Amph. rept. fauna Korea, p. 158 (?part).

Agkistrodon halys.-Kang and Yoon, 1975, Encycl. fauna flora Korea, 17:172 (part).

Range.-North Korea, South Korea including Cheju Island (Paik, 1982), the Soviet Far East (?subspecies *ussuriensis*) (Korotkov, 1981), eastern and southern China (?partly subspecies *ussuriensis*)(Chen et al.,1984), Japan (subspecies *blomhoffii*) (Sengoku,1979).

Distribution in DPRK (Fig. 4).-I. Pyongyang City: 4. Taesong-san (ZIP 182). -II. South Pyongan Province:13. Taesong-ho (Szyndlar, 1984:12).-V. Ryanggang Province: 28. Paegam (ZIP 35).-VI. North Hamgyong Province: 38. Kwanmo-bong (Szyndlar, 1984: addendum), 42. Ranam (ZIP 31), 44. Sanpong (ZIP 69-73). -VIII. Kangwon Province:51. Cholwon (Shannon, 1956:47; Gloyd, 1972:563), 61.Wonsan (Slevin, 1925:99; Shannon, 1956:47, 48; Gloyd, 1972:563).-X. South Hwanghae Province :70. Hyongchesom (ZZSiD 888).-XI. Kaesong City: 81. Kaesong (Shannon, 1956:48; Gloyd, 1972:563), 83. Sangdo-ri (Gloyd, 1972:563).

Description.-Material examined: One male (ZIP 31),4 females (ZIP 74, ZZSiD 801, 802(*), and 888), 8 juveniles of undetermined sex (ZIP 35, 69-73, 182, ZZSiD 855). In the male, ventrals 138, subcaudals 43, snout-vent length 340 mm, tail length 70 mm. In the females (ZZSiD 801, 802, 888, and ZIP 74), ventrals 134, 136,

(*) The specimens ZZSiD 801 and 802 were erroneously described by Szyndlar (1984:12) as males.

141, and 156, subcaudals 27, 32, 35, and 37, snout-vent and tail lengths 498+51 mm, 427+53mm, 578+76mm (ZIP 74 not measured). Anal undivided. Dorsal scales keeled. Scale rows 23-21-19 or 17. Preoculars 2; postoculars 2, rarely 3; temporals 2+3 or 2+4; upper labials 7 or 8; upper labial 3 entering eye; lower labials 9 or 10. Dorsum usually light brown or light gray with dark half bands consisting of paired oval blotches. The half bands number from 36-51. Juveniles are generally characterized by a lighter ground colour and more distinct pattern; one juvenile (ZZSiD 855) is light red with deep-red half bands.

Gloyd (1972), who summarized all former descriptions of *brevicaudus*, presented the following features of this species: ventrals and subcaudals in males 135-145 and 35-44; in females 140-149 and 30-38; number of half bands 23-36. In head scutellation Gloyd's examples do not differ from the ZIP and ZZSiD specimens except for the number of upper labials, which occasionally number 10 or 11. In the sample of South Korean *brevicaudus* examined by Paik et al., 1979 (cf. also Paik, 1982), the numbers of ventrals and subcaudals range from 142-151 and 32-52 in males, 140-159 and 32-47 in females. It should be noted that two of our females have distinctly lower number of ventrals and subcaudals. The largest specimens recorded from Korea are a male 620+90 mm and a female 598+82mm (Gloyd, 1972).

Habitat.-*Agkistrodon blomhoffii* has been collected in grassy areas in valleys and in the proximity of rice fields, on brushy hillside slopes with sandy loam soil and talus outcropping, and in bushes near forest (Hahn, 1960; Gloyd, 1972; Szyndlar, 1984). In mid October, 1984, an individual of this species (ZZSiD 888) was found on a tiny island near the coast of the Yellow Sea. During low water this island is connected with the mainland.

Agkistrodon caliginosus Gloyd, 1972

Agkistrodon blomhoffii brevicaudus Stejneger, 1907, Herp, Japan, p. 463 (part).-Slevin, 1925, Proc. Calif. Acad. Sci., (4), 14:99 (part).

Agkistrodon halys brevicaudus.-Steward, 1954, Copeia, p. 67.-Webb et al., 1962, Univ. Kansas Publ. Mus. Nat. Hist., 15:170 (part).

Ancistrodon halys brevicaudus.-Shannon, 1956, Herpetologica, 12:47 (part).-Dixon, 1956, Herpetologica, 12:56.

Agkistrodon caliginosus Gloyd, 1972, Proc. Biol. Soc. Wash., 85:563 (type locality: Seoul, South Korea).-Paik et al., 1979, Korean J. Zool., 22:passim.-Paik, 1982, Syst. stud. Serp. Korea, p. 72.- Gloyd and Conant, 1982, Japan. J. Herp., 9:77.-Szyndlar, 1984, Acta Zool. Cracov., 27: addendum.

Agkistrodon ussuriensis.-Toriba, 1986, Acta Herp. Sinica, 5:62.

Range.-North Korea and South Korea including Cheju Island (Paik, 1982).

Distribution in DPRK (Fig. 4).-V. Ryanggang Province: 28. Paegam (ZIP 67). -VI. North Hamgyong Province: 39. Machyang-ri (Szyndlar, 1984: addendum), 41.

Puryong (Slevin, 1925:99; Shannon, 1956:47, 48; Gloyd, 1972:568), 44. Sanpong (ZIP 62, 68), 45. "Shoko" (Slevin, 1925:99; Shannon, 1956:48; Gloyd, 1972:568). -VIII. Kangwon Province:51. Cholwon (Shannon, 1956:48; Gloyd, 1972:569), 61. Wonsan (Slevin, 1925:99; Shannon, 1956:47, 48; Gloyd, 1972:569).-XI. Kaesong City:81. Kaesong (Shannon, 1956:48; Gloyd, 1972:569), 83. Sangdo-ri (Gloyd, 1972:569).

Description.-One male (ZIP 62), ventrals 146, subcaudals 47, snout-vent length 440 mm, tail length 75 mm. Three females (ZIP 67 and 68, ZZSiD 853), ventrals 141, 152, and 159, subcaudals 30, 42, and 44, snout-vent length 380, 472, and 470 mm, tail length 45, 73, and 75 mm, respectively. Anal undivided. Scales keeled. Scale rows 23-21-17. Preoculars 2, in one case 1; postoculars 2, in one case 3; temporals 2+3, in one case 2+4; upper labials 7 or 8; upper labial 3 entering eye; lower labials 9 or 10. The whole body brown or even black with narrow dark-edged light crossbands. Total number of crossbands 28 (ZZSiD 853).

Characteristics of other Korean specimens, summarized by Gloyd (1972), are as follows: ventrals and subcaudals 139-153 and 40-52 in males, 143-155 and 36-48 in females; scale rows always 21 at midbody; preoculars always 2; postoculars always 2; upper labials 7, rarely 6 or 8; lower labials 10, occasionally 9 or 11. For a sample of South Korean *caliginosus*, described by Paik et al., 1979 (see also Paik, 1982), the numbers of ventrals and subcaudals are 142-150 and 40-51 for males, 141-152 and 31-47 for females. Lower limit of female subcaudals is therefore less in Paik's and our material than that stated by Gloyd. The largest female from Korea measured 520+90 mm (Gloyd, 1972).

Habitat.-*Agkistrodon caliginosus* was found on brushy or wooded hillsides; along rock walls or in piles of rocks; in damp, rocky, wooded, bushy or grassy areas near streams; and in low, marshy environment near rice fields. One specimen was observed on a sand island in the middle of a shallow stream (Steward, 1954; Shannon, 1956; Dixon, 1956; Webb et al., 1962; data summarized by Gloyd, 1972).

Remarks.-According to the latest studies of Toriba (1986), *Agkistrodon caliginosus* is considered to be a synonym of *ussuriensis*, described by Emelianov (1929) from the Soviet Far East. In the opinion of Gloyd and Conant (1982) and Chen et al. (1984) the latter form is one of subspecies of *Agkistrodon blomhoffii*. Toriba (1986) concluded that *ussuriensis* is a full species, distinct from *Agkistrodon blomhoffii* (cf. also Yosida and Toriba, 1986).

Agkistrodon saxatilis Emelianov, 1937

Trigonocephalus intermedius Strauch, 1868, Trudy Perv. Ziezda Russ. Inst. Zool., p. 295 (type locality: Irkutsk, Siberia) (?part). *Agkistrodon blomhoffii intermedius*. -Stejneger, 1907, Herp. Japan, p. 464 (part).

Agkistrodon blomhoffii brevicaudus.-Slevin, 1925, Proc. Calif. Acad. Sci., (4), 14 :99 (part).

Agkistrodon halys intermedius.-Maki, 1931, Monogr. snakes Japan, p. 209 (part).-Won, 1956, List animal names, p. 254. *Ancistrodon halys intermedius*.-(?) Babb, 1955, Philad. Herp. Soc. Bull., 1:22.

Ancistrodon halys.-Won, 1971, Amph. rept. fauna Korea, p. 158 (?part).

Agkistrodon halys.-Kang and Yoon, 1975, Encycl. fauna flora Korea, 17:172 (part).

Ancistrodon saxatilis Emelianov, 1937, Vest. Dalnevost. fil. Akad. Nauk SSSR, 24:26 (type locality: Vladivostok, USSR). *Agkistrodon saxatilis*.-Gloyd, 1972, Proc. Biol. Soc. Wash., 85:569.-Paik et al., 1979, Korean J. Zool., 22:passim.-Paik, 1982, Syst. stud. Serp. Korea, p. 70.-Szyndlar, 1984, Acta Zool. Cracov., 27: 12.

Agkistrodon intermedius saxatilis.-Gloyd and Conant, 1982, Japan. J. Herp., 9:77.

Range.-North Korea, South Korea excluding Cheju Island (Paik, 1982), the Soviet Far East (Korotkov, 1981), northeastern China (Chen et al., 1984).

Distribution in DPRK (Fig. 4).-I. Pyongyang City: 4. Taesong-san (ZIP 181). -II. South Pyongan Province: 8. Myohyang-san (Szyndlar, 1984:addendum).-V. Ryanggang Province: 28. Paegam (ZIP 66).-VI. North Hamgyong Province: 34. Chayu-ri (Szyndlar, 1984: addendum), 36. Chongjin (Gloyd, 1972:573), 40. Musan (Slevin, 1925:99; Shannon, 1956:48; Gloyd, 1972:573), 42. Ranam (ZIP 32), 44. Sanpong (ZIP 63, 64, 65).-VIII. Kangwon Province: 56. Onjong-ri (Szyndlar, 1984:12), 61. Wonsan (Slevin, 1925:99; Shannon, 1956:47, 48; Gloyd, 1972:573). -IX. North Hwanghae Province: 62. Chabi-san (ZIP 30), 65. Kumchon (ZIP 33, 34, 60, 61).-XI. Kaesong City: 83. Sangdo-ri (Gloyd, 1972:573).

Description.-Material examined: 7 males (ZIP 30, 32-34, 63, 65, ZZSiD 814), 6 females (ZIP 36, 64, 75, ZZSiD 851, 852, 854), and 3 juveniles of undetermined sex (ZIP 60, 61, 181). In males, ventrals 147-160 (mean 155.0±12.4) and subcaudals 41-44 (mean 42.3±1.0). In females, ventrals 150-164 (mean 156.6±5.2) and subcaudals 33-42 (mean 38.6±3.4). Largest male 600+80 mm (ZIP 30), largest female 590+75 mm (ZIP 64). Anal undivided. Scales keeled. Scale rows 25-23-17 or 19; in one case 21 scales at midbody (ZZSiD 852). Preoculars 2; postoculars 2; temporals 2+3 or 2+4; upper labials 8 or 7; upper labial 3 entering eye; lower labials usually 10, in single cases 9, 11, and 12. Dorsum light gray or light brown, with 42-54 (mean 49.3±4.2, N-7) transverse dark bands.

Gloyd (1972) presented the following characteristics of *Agkistrodon saxatilis*: ventrals and subcaudals 149-164 and 37-48 in males, 148-165 and 34-41 in females; scale rows 23, rarely 21, at midbody; preoculars 2; postoculars 2 or 3; upper labials 7 or 8; lower labials 10 or 11; number of transverse bands 29-44 (significantly lower than in our sample). Numbers of ventrals and subcaudals given by Paik et al. (1979) for South Korean *saxatilis* are 152-160 and 41-47 for males, 153-167 and 37-48 for females (cf. also Paik, 1982).

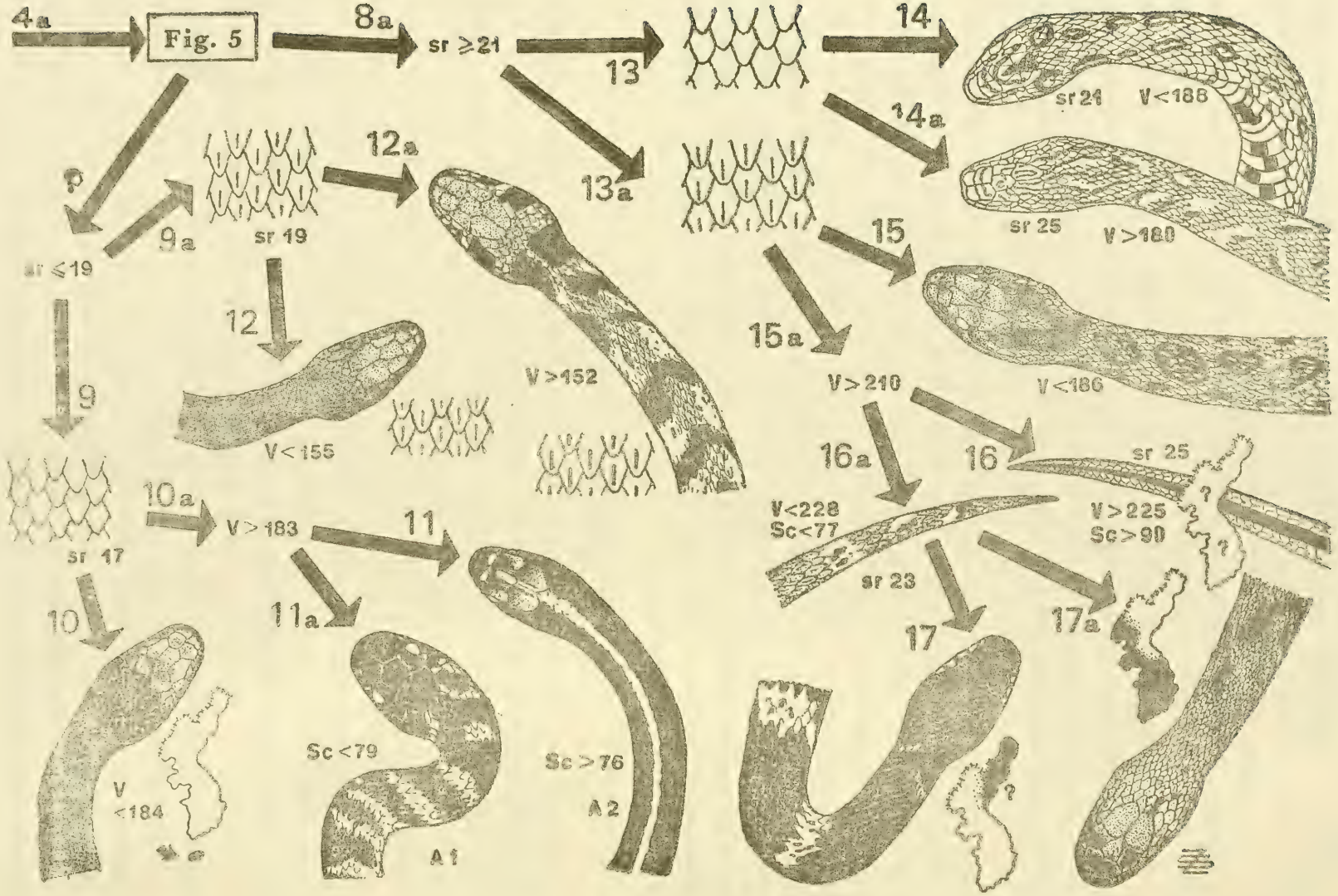
Habitat.-Specimens from the ZZSiD collection were captured in mountain forests near streams and in grass on bushy and rocky hillsides (Szyndlar, 1984; Dr. T. Tomek, personal communication, 1983).

Habits.-Available observations on the natural history of the Korean pit vipers come from rather older literature, when these snakes were regarded as belonging to a single species. Because of this, the following remarks deal with all Korean members of the genus *Agkistrodon*. According to Won's (1971) observations on 12 females in the Pyongyang Zoo, eggs are laid from August to the beginning of September; number of eggs 6-8 (apparent error-*Agkistrodon* is not oviparous). Webb et al. (1962) reported two gravid females, containing 14 and 3 embryos. Stomachs of two specimens dissected by these authors contained a mouse and a hamster. Pope's (1935:394) observations on the stomach contents of *"Agkistrodon halys"* do not comprise Korean specimens, as suggested by Shannon (1956:47). This species hibernates in the ground and under roots (Won, 1971). No data on bites caused by these venomous snakes are available from North Korea. In South Korea, Sawai and Lah (1978) summarized clinical studies of 82 snake-bites, including 4 fatal cases. Shannon (1956) and Hahn (1960) reported that these snakes are provided to South Korean shops for medical use. In North Korea, *Agkistrodon* is widely used for production of various kinds of therapeutic brandy, known under trade name "Pulrosul" or "Adder liquor".

Key to the snakes of Korea (Figs 5 and 6)

The key also includes the species described from South Korea, but never recorded from North Korea; they are indicated with asterisks (*).

1. Sea snakes; ventrals small; tail laterally depressed; nostrils dir ected vertically upward 2
1a. Terrestrial snakes; ventrals large; tail round; nostrils not directed upward 4
2. Ventrals much reduced in size; chin shields scarcely differentiated ..... *Pelamis platurus* (*)
2a. Ventrals small but distinct; two pairs of distinct chin shields 3
3. Body slender anteriorly; single anterior temporal ... *Hydrophis melanocephalus*
3a. Body not slender anteriorly; two anterior temporals ... *Hydrophis cyanocinctus*
4. Solenoglyphous venom apparatus present 5
4a. Solenoglyphous venom apparatus absent ..... 8 (see Fig. 6)
5. Loreal pit absent; top of head with numerous small scales anteriorly ..... *Vipera berus berus*
5a. Loreal pit present; top of head with 9 large plates anteriorly 6
6. Scales in 23 rows; cheek stripe not bordered above by well-defined light line;


4a
Fig. 5
8a
sr ≥21
13
14
sr 21
V<186
14a
sr 25
V>180
13a
12a
sr 19
9a
sr ≤19
9
12
V<155
V>152
15
15a
V>210
V<186
16a
16
sr 25
V<228
Sc<77
V>225
Sc>90
sr 23
17
17a
sr 17
10a
V>183
11
10
11a
V
<184
Sc<79
Sc>76
A2
A1

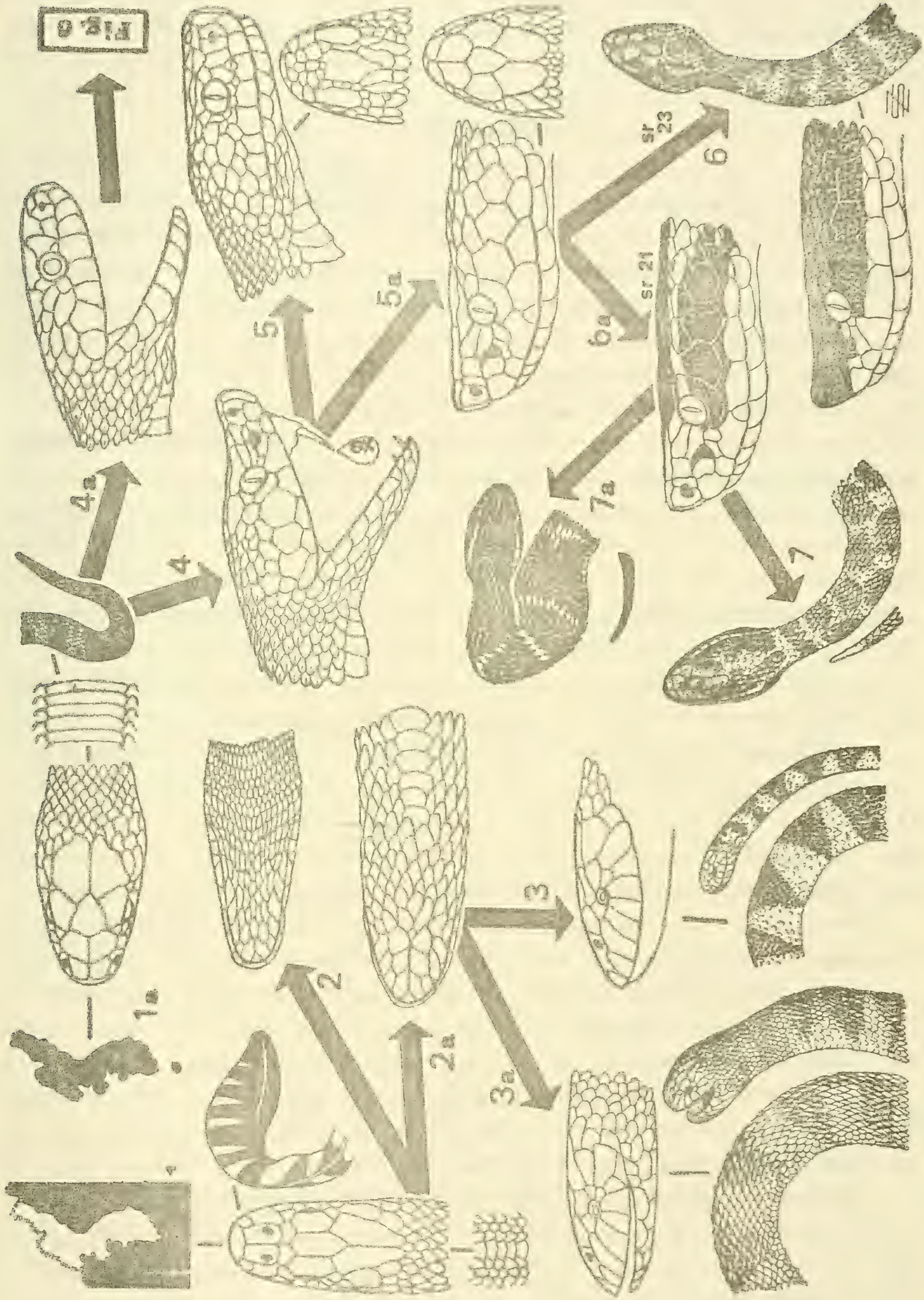


Fig. 6
1a
2
2a
3
3a
4
4a
5
5a
6
6a
7
7a
sr 23
sr 21

body pattern of dark crossbands ..... *Agkistrodon saxatilis*

6a. Scales in 21 rows; cheek stripe bordered above by well-defined light line; body pattern not as above 7

7. Body pattern of pairs of dark subelliptical blotches, opposite or alternating, on lighter ground colour; tongue black; tail light at tip .....
.....*Agkistrodon blomhoffii brevicaudus*

7a. Body dark brown or black with narrow, dark-edged, light crossbands; tongue pink; tail dark at tip ..... *Agkistrodon caliginosus*

8. Scales in 19 or fewer rows 9

8a. Scales in 21 or more rows 13

9. Scales smooth, usually in 17 rows 10

9a. Scales keeled, in 19 rows 12

10. Fewer than 184 ventrals; colour nearly uniform brownish gray above .....
.....*Sibynophis chinensis*(*)

10a. More than 183 ventrals; colour pattern not as above 11

11. Anal divided; more than 76 pairs of subcaudals; dorsum brown with yellow middorsal stripe extending throughout body length .....*Coluber spinalis*

11a. Anal undivided; fewer than 79 pairs of subcaudals; dorsum black with red or orange crossbands ..... *Dinodon rufozonatum rufozonatum*

12. Scales weakly keeled; fewer than 155 ventrals; colour uniform gray above, underside pale .....*Amphiesma vibakari ruthveni*

12a. Scales strongly keeled; more than 152 ventrals; colour olive-green above, immediately behind head with alternative black and red spots, underside dark
..... *Rhabdophis tigrinus*

13. Scales smooth 14

13a. Scales keeled 15

14. Scales in 21 rows; fewer than 188 ventrals; dorsum brown with four rows of black-edged spots, underside with black and red squares ...*Elaphe rufodorsata*

14a. Scales usually in 25 rows; more than 180 ventrals; dorsum gray with alternating light and dark markings; underside pale with irregular dusky spots.....
..... *Elaphe dione*

15. Fewer than 186 ventrals; dorsum light brown with three rows of round, dark brown spots; underside pale with numerous tiny spots .....*Elaphe davidi*

15a. More than 210 ventrals; colour pattern not as above 16

16. Scales usually in 25 rows; more than 225 ventrals, more than 90 pairs of subcaudals; tail with four black and four white longitudinal stripes .....
..... *Elaphe taeniura taeniura*(?*)

16a. Scales in 23 rows; fewer than 228 ventrals, fewer than 77 pairs of subcaudals; tail with crossbands 17

17. Adults black, with narrow white (anteriorly) and yellow (posteriorly) cross-

bands ..... *Elaphe schrenckij schrenckii*

17a. Adults brown, with dark bands, indistinct anteriorly and distinct posteriorly ..... *Elaphe schrenckii anomala*

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Gazetteer

		I. Pyongyang City			
1.	Pyongyang	39°01' 125°44'	4.	Taesong-san	39°04' 125°50'
2.	Sogam	39°13' 125°41'	5.	Wonsin-ri[1]	
3.	Sunan	39°10' 125°41'			
		II. South Pyongan Province			
6.	Hansong[2]		10.	Sinyang	39°17' 126°28'
7.	Kaechon	39°42' 125°54'	11.	Songchon	39°15' 126°13'
8.	Myohyang-san	40°01' 126°19'	12.	Sukchon	39°24' 125°37'
9.	Opa	39°19' 125°38'	13.	Taesong-ho	38°55' 125°25'

	III. North Pyongan Province		
14. Changsong	40°28' 125°13'	20. Sogha-ri[4]	
15. Chongju	39°41' 125°13'	21. Sonchon	38°48' 124°54'
16. Chonma-san	40°12' 125°02'	22. Ssuksom[5]	39°30' 125°12'
17. Ryongampo	39°56' 124°22'	23. Uiju[6]	40°12' 124°32'
18. Sinmi-do[3]	39°33' 124°54'	24. Unmu-do	39°24' 125°07'
19. Sinuiju	40°06' 124°23'		
	IV. Chagang Province		
25. Yangcho-ri[7]		26. Yangdok-ri	41°16' 126°40'
	V. Ryanggang Province		
27. Kanpaeg-san	41°50' 128°18'	31. Rimyongsu	41°47' 128°15'
28. Paegam	41°34' 128°48'	32. Sobaek-san	41°54' 128°12'
29. Paekdu-san	42°00' 128°05'	33. Wisupyong[8]	
30. Puksubaek-san	40°42' 127°45'		
	VI. North Hamgyong Province		
34. Chayu-ri	42°07' 129°26'	40. Musan	42°14' 129°14'
35. Chilbo-san	41°02' 129°36'	41. Puryong[11]	42°04' 129°43'
36. Chongjin[9]	41°48' 129°48'	42. Ranam[12]	41°43' 129°42'
37. Hoeryong[10]	42°27' 129°47'	43. Sahoe-ri[13]	42°27' 130°30'
38. Kwanmo-bong	41°42' 129°16'	44. Sanpong[14]	42°20' 130°24'
39. Maehyang-ri	41°33' 129°24'	45. "Shoko"[15]	41°56' 129°44'
	VII. South Hamgyong Province		
46. Chail-bong	40°38' 127°44'	49. Kowon[16]	39°29' 127°14'
47. Changjin	40°23' 127°14'	50. Pujon	40°29' 127°38'
48. Kachin	39°32' 127°32'		
	VIII. Kangwon Province		
51. Cholwon[17]	38°20' 126°53'	57. Popdong	38°58' 127°04'
52. Ichon	38°28' 126°53'	58. Sambang-ri	38°43' 127°21'
53. Kosan	38°51' 127°24'	59. Samil-po	38°41' 126°18'
54. Kosong	38°45' 128°10'	60. Tongchon	38°57' 127°53'
55. Kumgang-san[18]	38°39' 128°07'	61. Wonsan[20]	39°09' 127°25'
56. Onjong-ri[19]	38°41' 128°12'		
	IX. North Hwanghae Province		
62. Chabi-san[21]		66. Kurig-ri	38°29' 126°29'
63. Chesog-san[22]		67. Paegyang[23]	
64. Kitan-ri	38°22' 126°29'	68. Pyongsan	38°19' 126°24'
65. Kumchon	38°09' 126°29'		
	X. South Hwanghae Province		
69. Haeju	38°02' 125°44'	71. Kangryong	37°55' 125°30'
70. Hyongchesom	37°58' 125°41'	72. Kuwol-san	38°29' 125°15'

73. Ongjin	37°56' 125°22'	77. Sinyang-san[24]	
74. Paechon	38°00' 126°19'	78. Sunwi-do	37°43' 125°16'
75. Pyoksong	38°02' 125°32'	79. Suyang-san	38°09' 125°42'
76. Samchon	38°20' 125°18'		

XI. Kaesong City

80. Changpung	38°04' 126°41'	83. Sangdo-ri[25]	37°53' 126°34'
81. Kaesong	37°58' 126°33'	84. Haeson-ri	37°59' 126°30'
82. Pagyon-pokpo	38°04' 126°34'		

Meaning of suffixes used in Korean geographic names: "-bong"= mountain, "-do" = island, "-ho" = barrier lake, "-po" = lake, "-pokpo" = waterfall, "-ri" = village, "-san" = mountain.

Captions

Fig. 1. Reptile localities in the Democratic People's Republic of Korea. The map shows location of the sites of known coordinates (Arabic numerals), political subdivision of the country into provinces (Roman numerals), and a contour line at 1,000 metres. Serial numbers correspond with those of the localities listed in the Gazetteer.

Fig. 2. Distribution in DPRK of four species of the Colubridae.

Fig. 3. Distribution in DPRK of four species of the Colubridae.

Fig. 4. Distribution in DPRK of four species of the Viperidae.

Fig. 5. Pictorial key to non-colubrid snakes of Korea (2 and 2a adopted from Stejneger, 1907). Numbers correspond with those in the "Key"(see pp. 49, 53).

Fig. 6. Pictorial key to colubrid snakes of Korea. Abbreviations: A - anal, Sc - subcaudals, sr - scale rows, V - ventrals. Numbers correspond with those in the "Key" (see pp. 52—53).

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1) coordinates unknown. 2) in Pyongwon county, coordinates unknown. 3) also known as Sin-do. 4) in Sonchon county, coordinates unknown. 5) formerly Ae-do. 6) Ujo of Slevin (1925). 7) in Chasong county, coordinates unknown. 8) in Pochon county, coordinates unknown. 9) Seishin of Gloyd (1972). 10) Hoi-ryong of Slevin (1925). 11) Pu-Ryong of Slevin (1925) and Shannon (1956). 12) Nanam of Shannon (1956). 13) formerly Chonghak-dong, Chonghyang-ni of Malnate (1962). 14) formerly Unggi. 15) Korean name undetermined; coordinates fide Gloyd (1972). 16) Kowan of Shannon (1956). 17) Ch'orwen of Shannon (1956) and Gloyd (1972). 18) Szyndlar's (1984) localities Samson-am, Kuryong and Pyohunsa are referred to as Kumgang-san. 19) Szyndlar's (1984) locality Singye-sa is referred to as Onjong-ri. 20) Gensan of Giglioni and Salvadori (1887). 21) in Yontan county, coordinates unknown. 22) in Kumchon county, coordinates unknown. 23) in Kumchon county, coordinates unknown. 24) in Haeju county, coordinates unknown. 25) Songdo of Gloyd (1972).

朝鲜民主主义人民共和国的爬行动物　Ⅰ.蛇亚目

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摘　要

本文报道北朝鲜的14种蛇的形态、分布以及自然历史。此外，还讨论了仅分布于南朝鲜的二种蛇：(?) *Sibynophis chinensis* 和 *Pelamis platurus*，以及近年来未见报道自朝鲜半岛的 *Elaphe taeniura taeniura*。除分类描述外，还附有朝鲜蛇类的分布地图和鉴别索引。

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A NEW SPECIES OF Varanus FROM YUNNAN, WITH MORPHOLOGICAL COMPARISON BETWEEN IT AND SIX OTHER SPECIES FROM SOUTHEAST ASIA

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In Southeast Asia so far have been known six species of *Varanus, bengalensis, dumerili, flavescens, monitor, rudicollis,* and *salvator* (Rooij, 1915; Smith, 1930,1935; Harrison, 1957; and Taylor, 1963). A specimen captured from Yunnan in 1986 is classified as a new species and described as follows. The type specimen is preserved in Kunming Institute of Zoology, Academia Sinica.

Varanus irrawadicus sp. nov.

Type specimen: KIZ86001, adult male. Wanding valley (ca. 24°N, 98°E), Yunnan, 1986.

Diagnosis: *V. irrawardicus* differs from *V. bengalensis* in having, supraoculars small and not widened (Figs. 1, 2:i); nostril at midway between eye and snout tip, i.e. A=B, where A represents the distance from nostril to eye, and B from snout tip to nostril; ventrals in 75 transverse rows; chevron-shaped marking on nape absent.

Description: Head elongated, 94 mm long, 48 mm wide; snout length 47 mm; snout-vent length 515 mm; tail length 720 mm; snout rather pointed and a little depressed; rostral process distinct; nostril appearing as an oblique slit at midway between eye and snout tip; scales which are anterior to nostril irregular and larger than the other scales on the head, of which supraoculars are the smallest, and not widened; temporals small, almost equal to supraoculars; tympanum large and oval; distance from eye to tympanum equal to from eye to nostril; mentals slightly smaller than rostrals; chin-shields 4 pairs, with the two posteriormost pairs separated by small scales; a deep mental groove present; nuchals smooth, oval, not enlarged, slightly projected, and pitted; posterior dorsals strongly keeled and all pitted; ventrals between axilla and groin smooth in 75 transverse rows; preanal pores 2 pairs; nuchal folds indistinct; tail with 2 rows of crests.

Digits elongated, clawed, and compressed; 3rd finger with 20 and 4th toe with 22 transverse rows of scales on under surface.

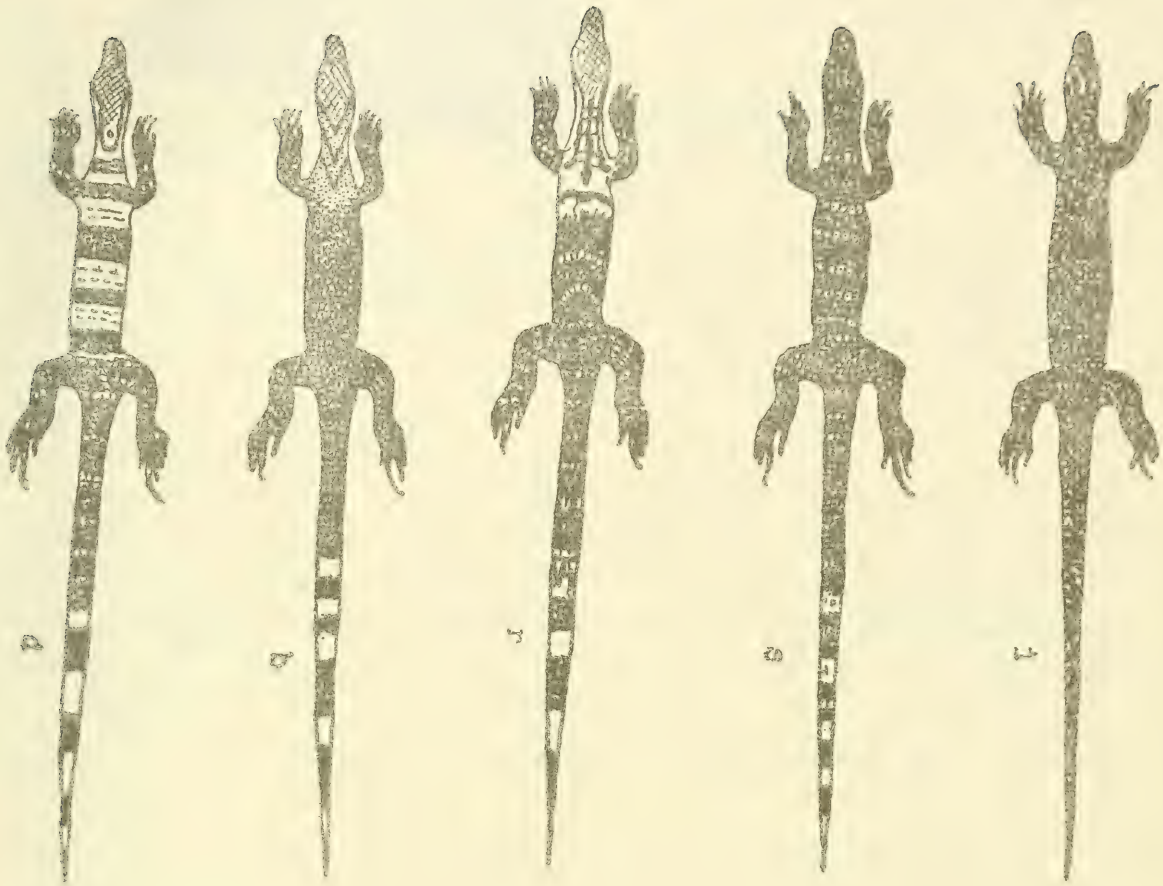

Figure 1 Comparison of the colour patterns of five species

i – *V. irrawadicus*. s – *V. salvator*. r –*V. rudicollis*.
b – *V. bengalensis*. d – *V. dumerili*. (s, r, b, d, from Harrison 1957).

Back blackish brown with small yellow spots; nape without chevron-shaped marking but with marbling on and under the neck; head with black reticular markings; temporal streak dark and distinct; narrow, transverse bar indistinct on tail; ventral and under surface of leg scattered with some blackish brown spots.

Morphological comparison between seven species of *Varanus*:

V. bengalensis (Daudin) (Figs. 1, 2:b)

1.5A=B; supraoculars 4-7, transversely widened; head scales small, subequal; supralabials 21; infralabials 25; nuchals on the anterior surface of nape smooth, roundish and comparatively large; back covered with small, oval, and keeled scales; ventrals smooth in about 80 transverse series; fourth toe with 25-28 transverse rows of scales.

V. dumerili (Schleger) (Figs. 1, 2:d)

2A=B; median supraoculars slightly enlarged; scales between eyes and snout

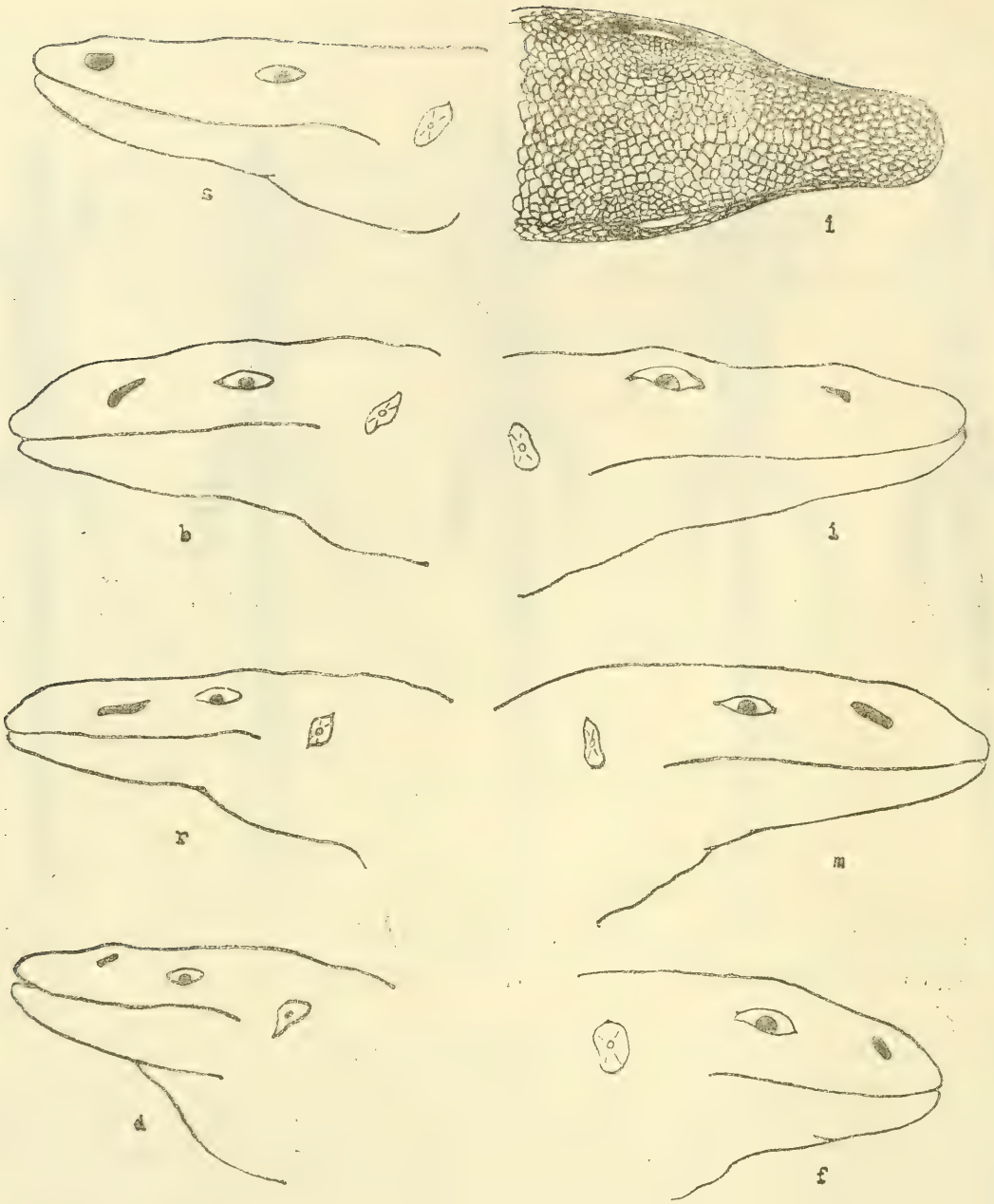

Figure 2 The position of the nostril relative to the eye and snout for seven species of *Varanus*: i - *V. irrawadicus* m -*V. monitor*. f -*V. flavescens*. s -*V. salvator*. b -*V. bengalensis*.r -*V.rudicollis*. d-*V. dumerili* (i - upper veiw showing supraoculars not enlarged)

tip slightly enlarged transversely; scales on head not very large, subequal; nuchals very large, almost as long as broad, those at the posterior flattened; ventrals slightly keeled in 75-85 transverse series; fourth toe with 17 transverse rows of scales on under surface; a pair of preanal pores present in males.

V. flavescens (Hardwicke and Gray) (Fig. 2:f)

A>B; medial supraoculars widened transversely; about 18 supralabials and a similar number of infralabials; nuchals larger than head scales, all keeled; ventrals

in 65-75 transverse rows.

V. irrawadicus sp. nov.

A=B; supraoculars small and irregular; scales on snout and interorbital region smooth, larger than those on head,

V. monitor (Linnaeus) (Fig. 2:m)

A<B; nostril nearer to the orbit than is snout tip; supraoculars small, subequal; head scales rounded, not keeled, larger than nuchals, similar in size to anterior dorsals; ventrals smooth in 90-110 transverse rows.

V. rudicollis (Gray) (Figs. 1, 2:r)

2A=B; supraoculars 3-6, transversely widened; head scales not very large, subequal; nuchals very large, strongly keeled; body covered with small and strongly keeled scales; ventrals keeled in 85 transverse rows; a pair of preanal pores present in males.

V. salvator (Laurenti) (Figs. 1, 2:s)

2.5A=B; supraoculars about 6, widened transversely; scales on the snout and interorbital region largest; supralabials 36; nuchals large and hump; body covered with large and strongly keeled scales; ventrals quite large, in 76-80 transverse series; fourth toe with 29 transverse series of scales on under surface; two pairs of preanal pores present.

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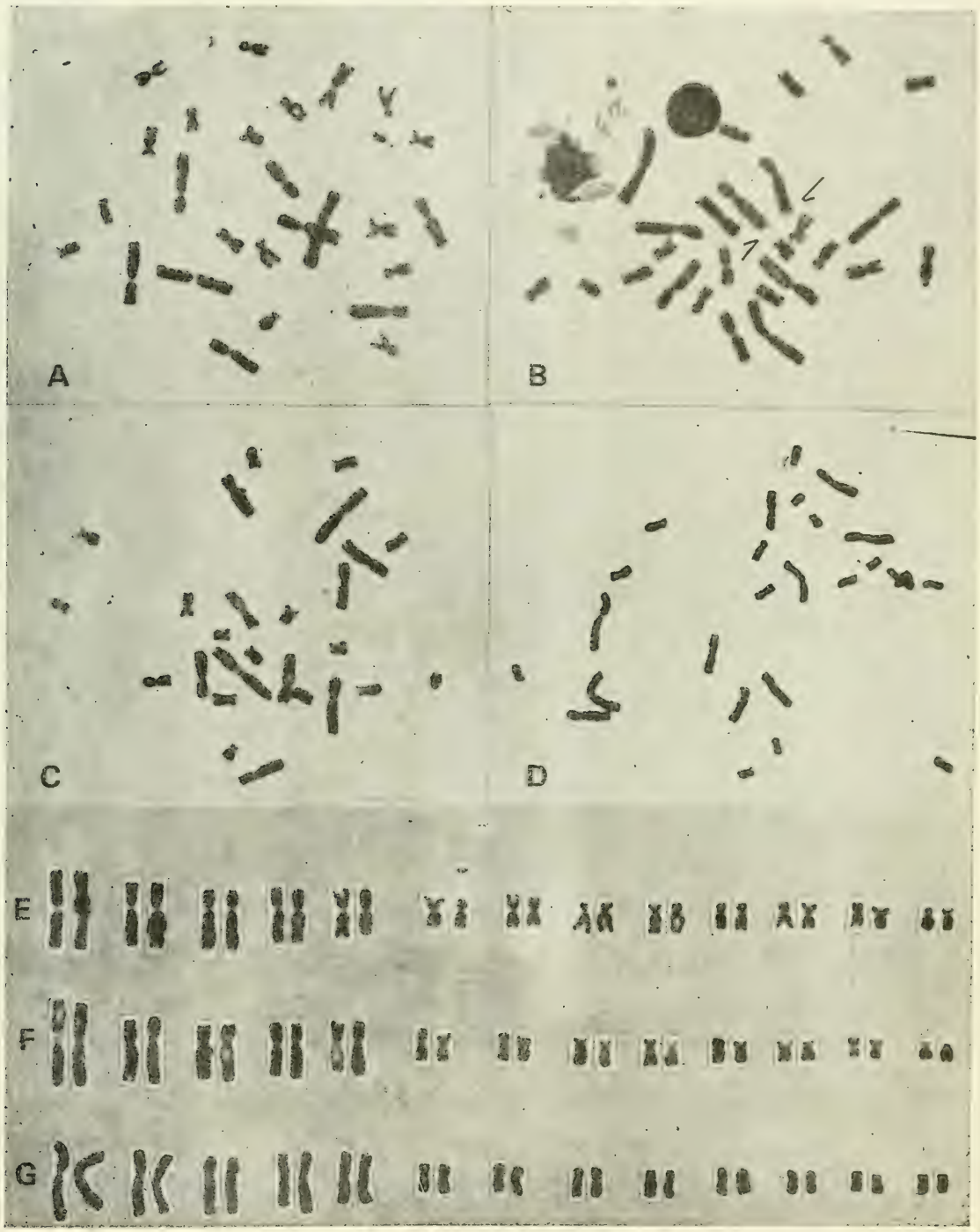
云南巨蜥一新种——伊江巨蜥的描述及其与东南亚六种的形态学比较

摘　　要

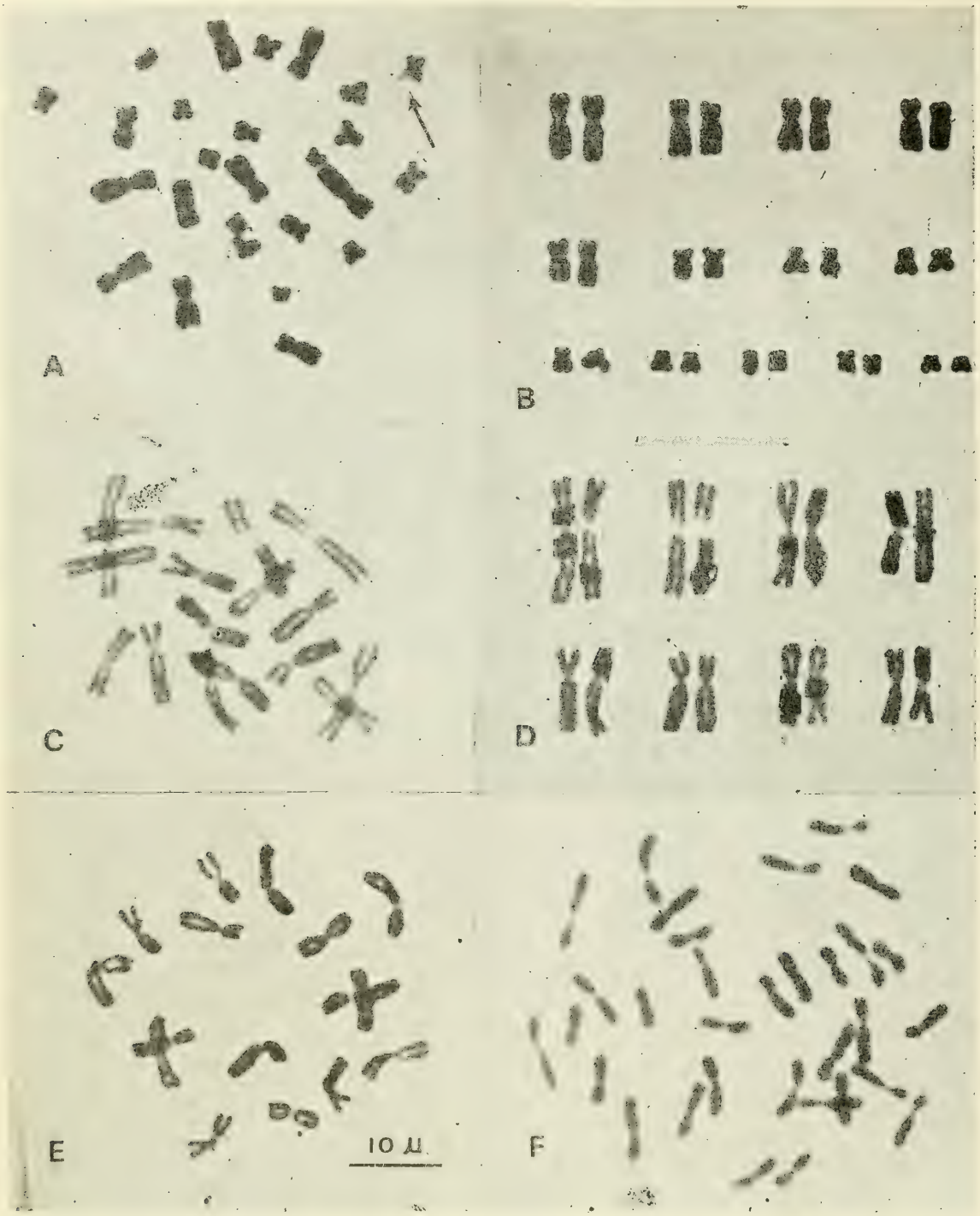
据文献记载，东南亚有六种巨蜥。1986年我们从云南省畹町河谷（约北纬24°，东径98°）采到一雄性成体巨蜥标本。经鉴定为一新种，命名为伊江巨蜥（*Varanus irrawadicus*）。模式标本KIZ 86001保存于中国科学院昆明动物研究所。本文对此新种作了描述，并与东南亚的六个已知种作了形态学上的比较。

Zhao Ermi et al.: Karyotypes of Chinese species of *Occidozyga* (Family Ranidae), with discussion on the taxonomic status of *O. laevis martensi*



Efplanation to the Figures:
Figs. A, E: the karyotypes of *Occidozyga laevis* (♀) , Hainan Island population.
Fig. B: the karyotype of *O. laevis* (♂) , Hainan Island population.
Figs. C, F: the karyotypes of *O. laevis* (♀) , Xishuangbanna population.
Figs. D, G: the karyotypes of *O. martensi* (♀) , Xishuangbanna population.

Tan An-ming: A rare case of karyotype in Anura—A preliminary study on the karyotypes of *Philautus doriae* (Boulenger) with different diploid numbers of 26 and 16



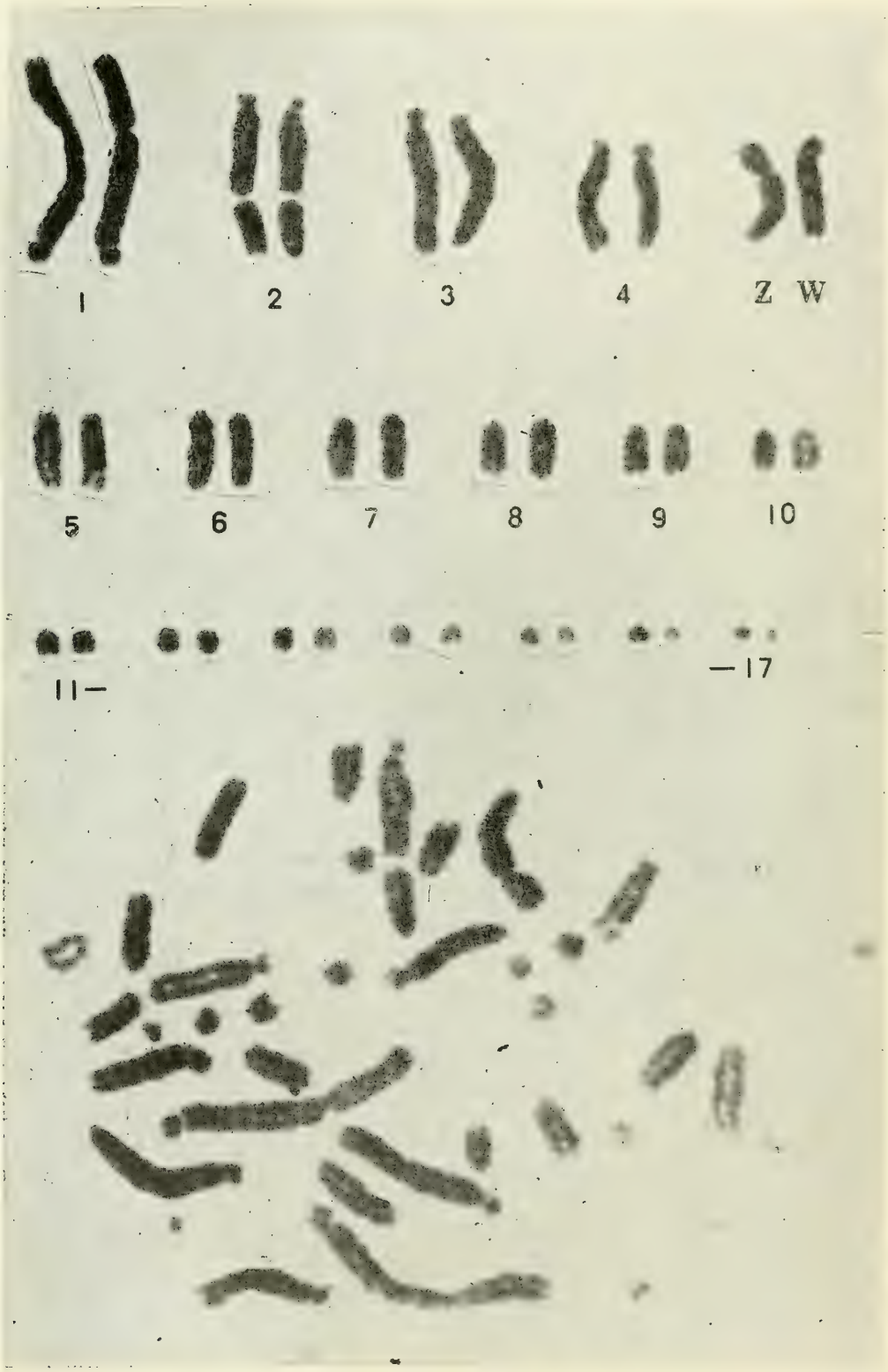
Captions for Plate Ⅱ:

Figs A–B: The karyotype of 2n=26. Arrow points at the satellite at the terminal of the long arm of chromosome No. 12.

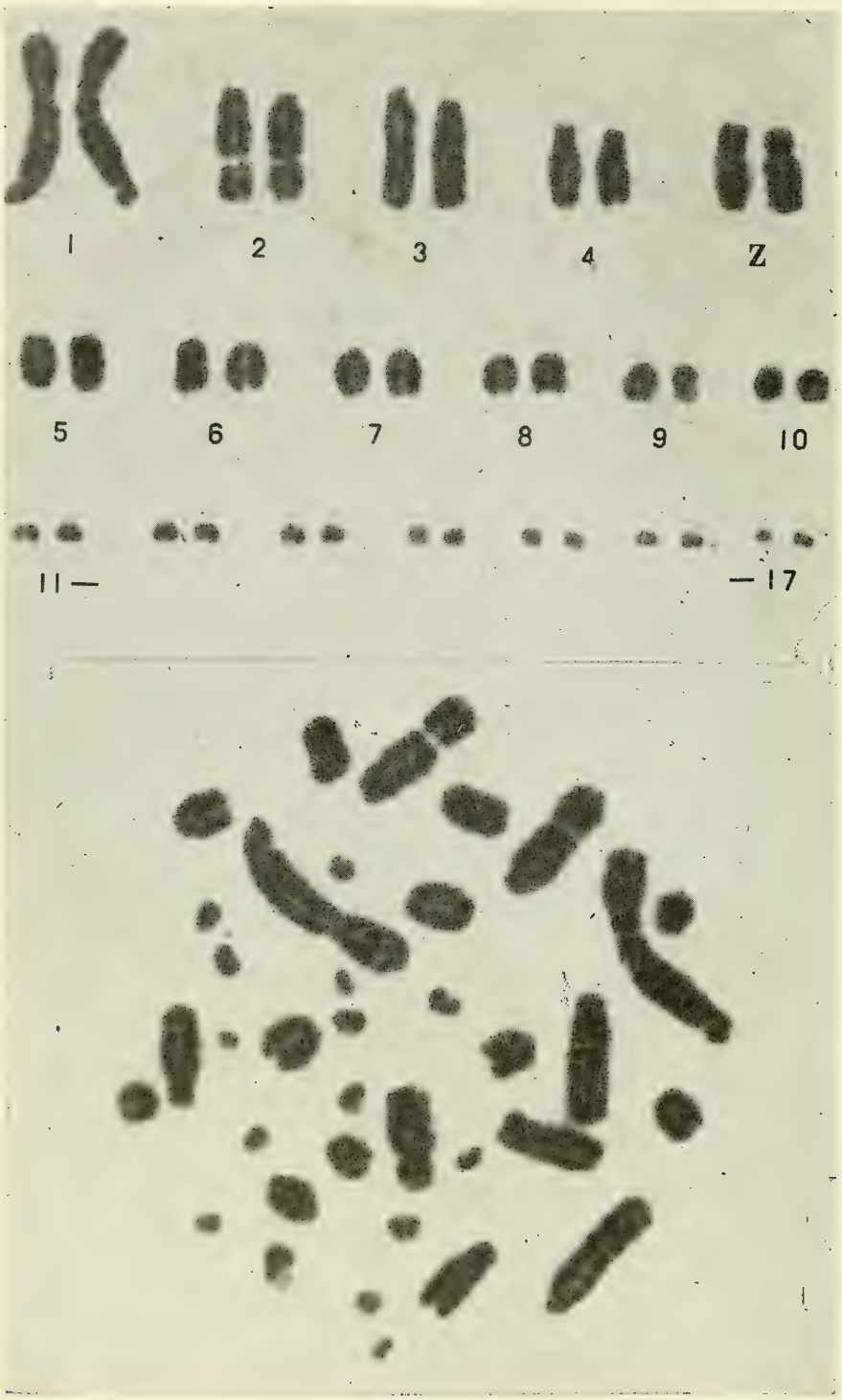
Figs C–E: The karyotype of 2n=16.

Fig F: An anaphase chromosome of 2n=16.

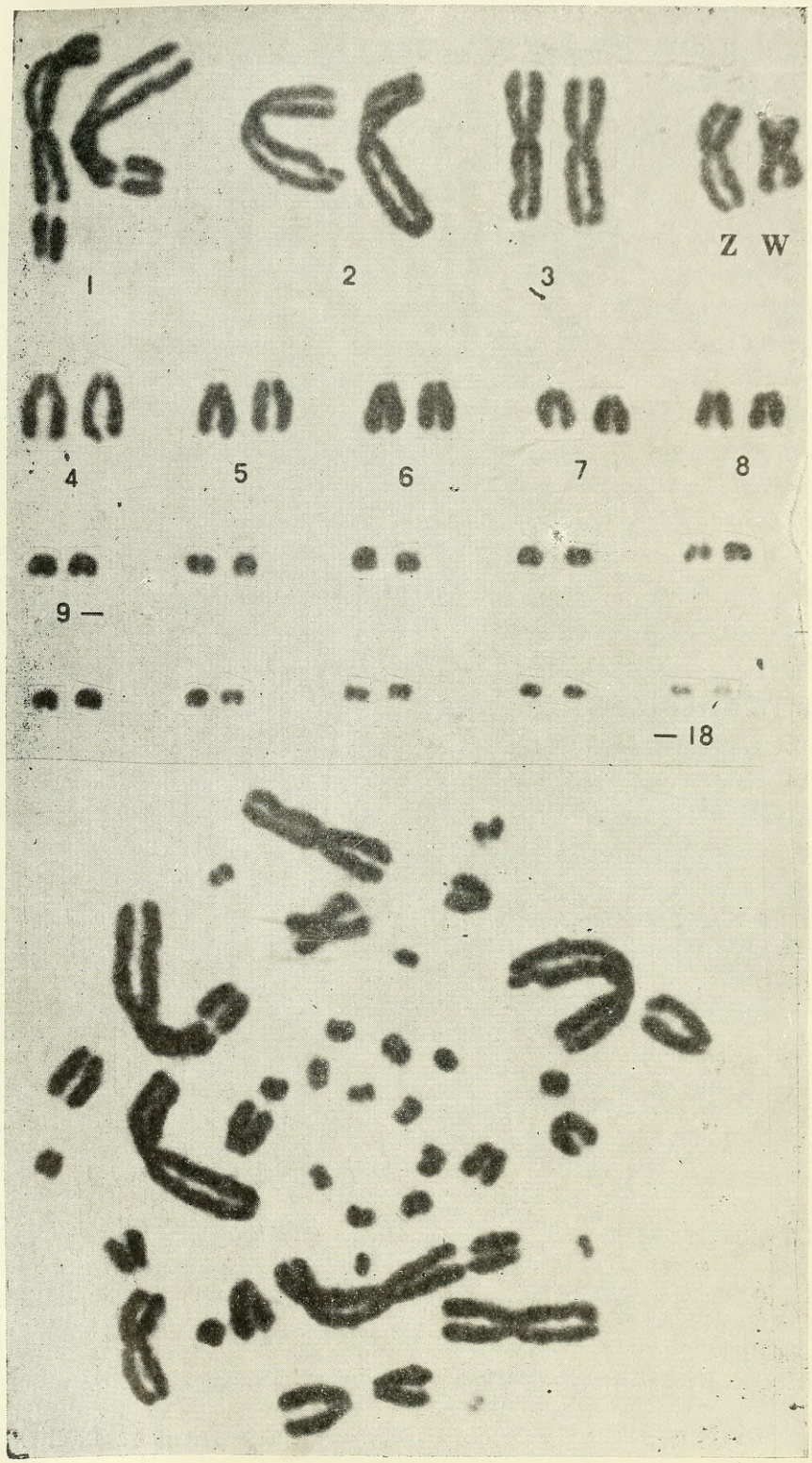
All chromosomes are from male bone marrow cells of different individuals of *Philautus doriae*. Scale equals 10 μm.



Chromosomes of a female *Bungarus multicinctus* from Taiwan.



Chromosomes of a male *B. candidus* from Thailand.



Chromosomes of a female *B. fasciatus* from southern China.

Program Announcement

FIRST WORLD CONGRESS OF HERPETOLOGY

Canterbury, United Kingdom · 11-19 September 1989

THE CONGRESS will be held at University of Kent and in Canterbury, H. R. H. Prince Philip, President of the World Wildlife Fund, will serve as Patron of our Congress and Professor Angus d'A. Bellairs as Honorary President. The Congress will also serve as the official 1989 meetings of Societas Europaea Herpetologica, Herpetologists' League, and Society for the Study of Amphibians and Reptiles. It will be co-hosted by the Zoological Society of London, Fauna and Flora Preservation Socieey, Societas Europaea Herpetologica, and The British Herpetological Society.

The Scientific Program, subject to modification, is listed below. Plenary speakers and Convenors are now being invited. *Persons who wish to participate in events should contact the Convenors*, whose names and addresses may be obtained from the Secretariat (see below). There will be poster sessions open to all persons but no oral contributed papers. All presentations will be in English, but discussions can be in other languages.

PLENARY LECTURES

THE STATE OF HERPETOLOGY · EVOLUTION AND ECOLOGY OF PARTHENOGENESIS · BIOGEOGRAPHY OF SOUTH AMERICA · INTERNATIONAL CONSERVATION · SEXUAL SELECTION · SYSTEMATICS AND PHYLOGENY · PALEOHERPETOLOGY · ECOLOGICAL PHYSIOLOGY · COMMUNITY ECOLOGY · BIOLOGY OF SALAMANDERS

SYMPOSIA (S), WORKSHOPS (W) and ROUNDTABLES (R)

Conservation

S.1. CONSERVATION AND MANAGEMENT OF SPECIES
S.2. EFFECTS OF POLLUTION ON HERPETOFAUNA
S.3. CAPTIVE MANAGEMENT

Behavior

S.5. SEXUAL SELECTION AND COMMUNICATION
S.6. ENVIRONMENTAL SEX DETERMINATION

Ecology

S.8. LONG-TERM STUDIES
S.9. SNAKE ECOLOGY AND BEHAVIOR
S.10. ADAPTATIONS TO EXTREME ENVIRONMENTS
S.11. AMPHIBIAN COMMUNITY ECOLOGY

Evolution

S.4. HEALTH AND DISEASE
R.1. IUCN HERPETOLOGY SPECIALIST GROUPS
R.2. CONSERVATION PROBLEMS
S.7. ORIENTATION, NERVOUS SYSTEM AND SENSES
R.3. OPTIMAL SIZES OF EGGS AND CLUTCHES
R.4. MIMICRY AND PREDATOR-PREY BEHAVIOR
S.12. HERPETOFAUNAS : EXPLORATIONS AND STUDIES
R.5. THE ECOLOGY OF THE TUATARA
W.1. SKELETOCHRONOLOGY
W.2. FIELD METHODS AND BIOTELEMETRY
S.16. ISLAND HERPETOFAUNAS

S.13. EVOLUTION AND PHYLOGENY OF FROGS
S.14. ORIGIN OF AMPHIBIA AND REPTILIA
S.15. PALEOHERPETOLOGY

Systematics and Genetics

S.18 MOLECULAR SYSTEMATICS

S.19. CYTOGENETICS
S.20. PARTHENOGENESIS AND HYBRIDOGENESIS
S.21. SYSTEMATICS AND PHYLOGENY

Physiology and Development

S.23. ENERGETICS
S.24. ECOLOGICAL PHYSIOLOGY

General Topics

R.9. FIELD RESEARCH AND NATIONAL REGULATIONS
R.10. AMATEUR CONTRIBUTIONS TO HERPETOLOGY
S.17. LIFE HISTORY EVOLUTION OF TURTLES
R.6. BIOGEOGRAPHIC REVIEW OF THE CONTINENTS
R.7. CAECILIAN BIOLOGY AND EVOLUTION
S.22. BIOLOGY AND GENETICS OF PIPIDAE
R.8. PHYLOGENY AND CLASSIFICATION OF LIZARDS
W.3. MOLECULAR TECHNIQUES
W.4. AMPHIBIAN LARVAE
W.5. PHYLOGENETIC ANALYSIS
S.25. FUNCTIONAL MORPHOLOGY
S.26. REPRODUCTIVE PHYSIOLOGY
S.27. DEVELOPMENTAL PROCESSES
R.11. MEDICAL AND RESEARCH ASPECTS OF VENOMS
W.6. PHOTOGRAPHIC TECHNIQUES

EXCURSIONS: Pre- and post-Congress trips are planned to Europe, Russia, the Mediterranean, Belize, Honduras, the Amazon, Ecuador, various sites in Africa, Indian Ocean, Pakistan, Malaysia, China and Australia, each led by professional herpetologists. Day or half-day trips to Darwin's home, London, Cambridge, Oxford and Paris are also planned.

FIRST CIRCULAR: The complete program and full details of excursions, including prices, are given in the First Circular, available from the Secretariat. This includes a Provisional Registration Form. Registration begins January 1988; £90 fee covers abstract book and program, refreshments, and costs of hiring meeting rooms and equipment. *Advance registration is strongly encouraged* for planning purposes and to insure that you receive all other announcements promptly.

SECRETARIAT: Address all inquiries to: First World Congress of Herpetology, Ecology Research Group, Rutherford College, University of Kent, Canterbury, Kent CT2 7NY, UK. *Telephone*: (0227) 764000, *ext.* 3501. *Telex*: 965449.

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